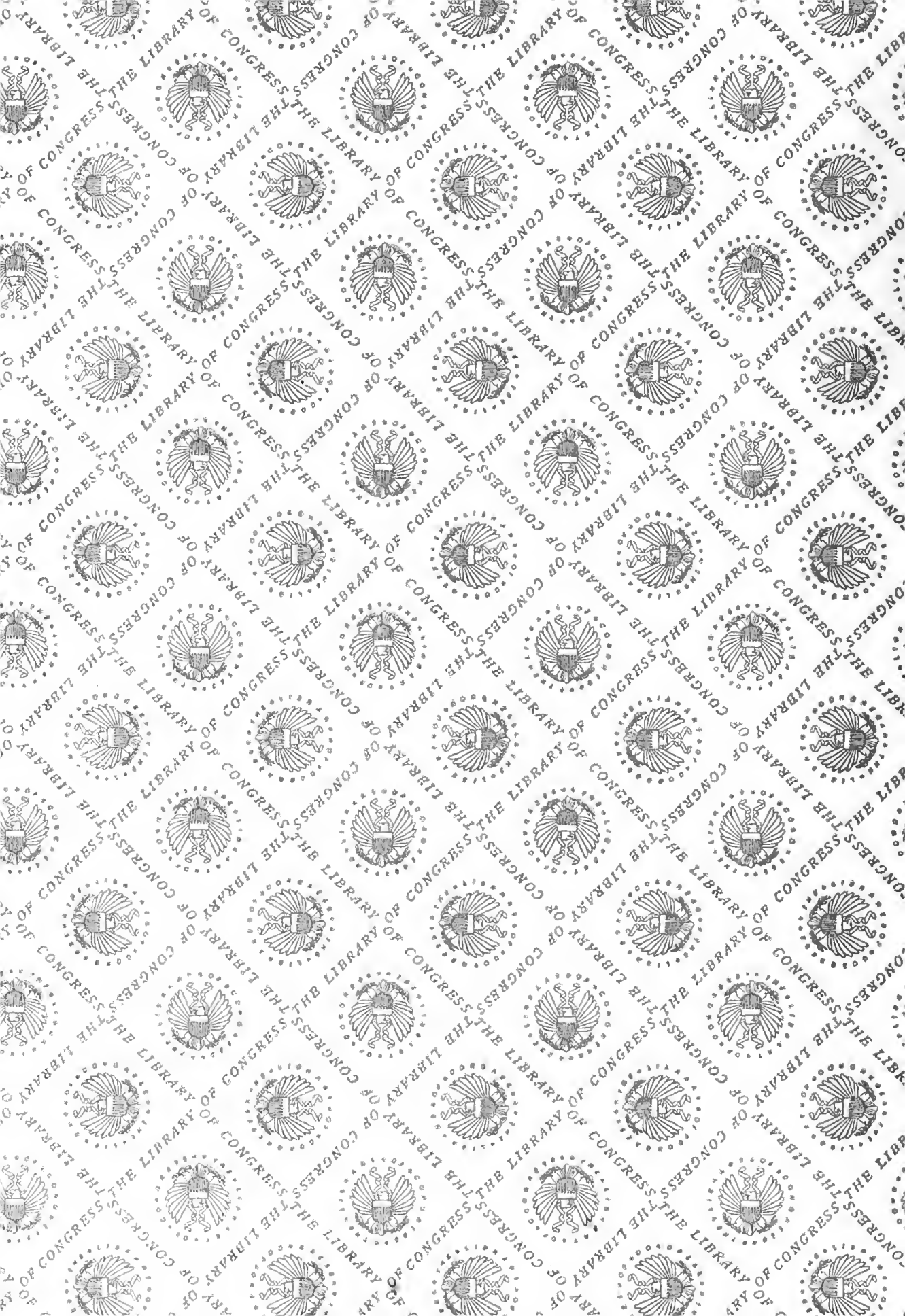
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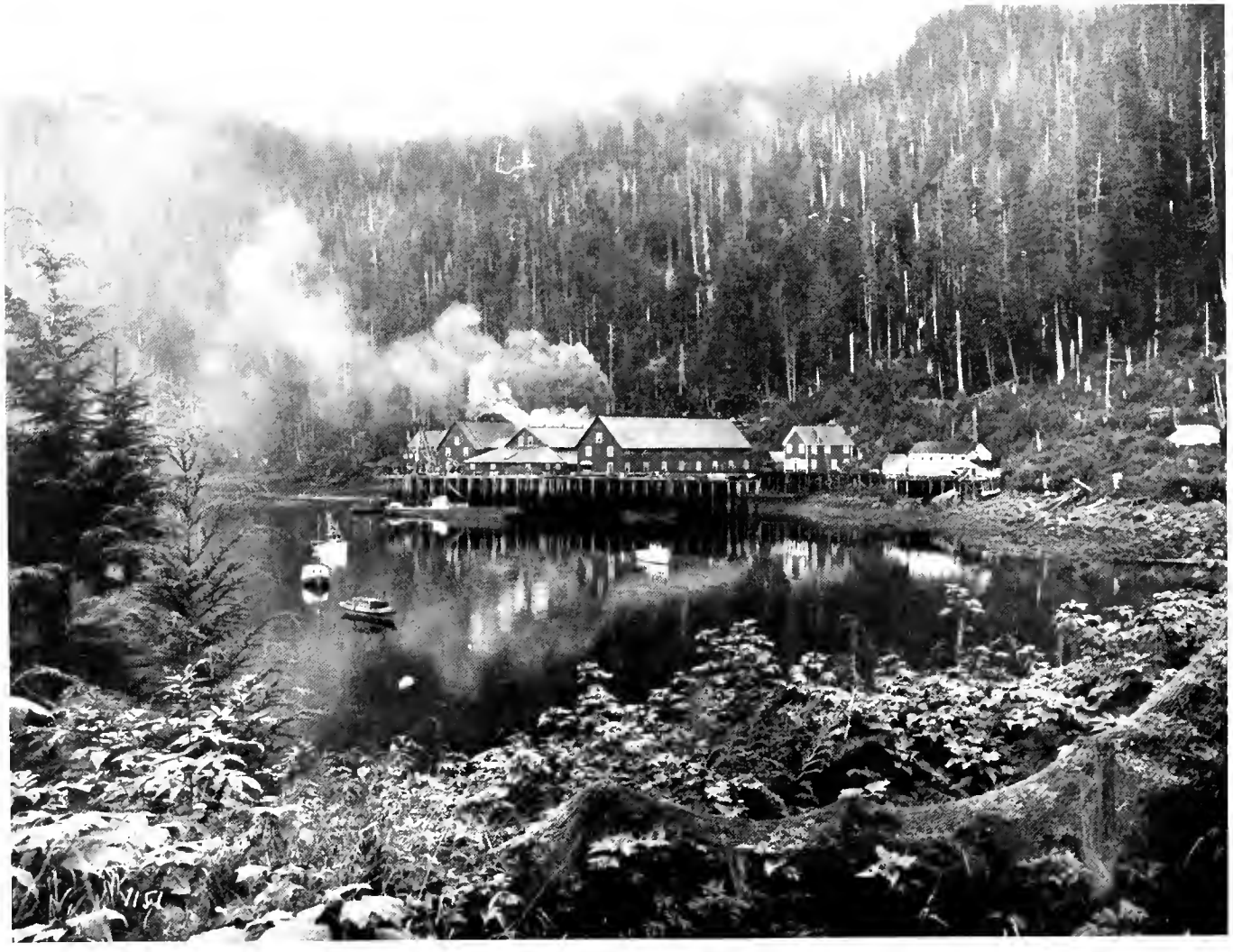

AN ALASKA SALMON CANNERY.

THE

CANNING

OF

FISHERY PRODUCTS

Showing the History of the Art of Canning; the Methods Followed With Each Species, and Suggestions for Canning Unutilized Species; Where, When and How They Are Obtained; Together With Other Information of Much Value to Canners

BY

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PREFACE

WHEN I began my active fishery career there were but few persons who knew much about the art of canning fishery products, and these were chary about imparting what they knew to others, who might, in time, develop into competitors. On many occasions I was approached by seekers after information along these lines, and in endeavoring to help them I soon discovered that there was not then, and the same holds true today, available any work which treated at length and fully upon the canning of fishery products, and that what little had been published was in very fragmentary shape and inaccurate in many ways. Appreciating the great need of such a work, I began some years ago to collect data for same, and an intimate connection with the fishing industry of the United States for twenty-four years—part of that time as editor of the Pacific Fisherman of Seattle, Wash., the organ of the great fisheries of the Pacific, and as a practical canner, but mainly as Field Agent of the United States Bureau of Fisheries, in the course of which I have visited, some of them many times, practically every fishing camp and packing plant in the United States proper, Alaska and Hawaii, also various plants in Canada and Mexico—greatly aided the work. Most of the processes described have been developed in the canneries, where they have stood the test of many years' actual work. The book is written for the cannery operator, and not for chemists or bacteriologists, and as a result has been made as non-technical as possible so as to be easily understood by those for whom it is written, but few of whom are versed in the sciences of chemistry and bacteriology.

I am indebted to so many sources, both official and private, for information used in this work, that it is impossible to name them all, but the following were especially helpful: Dr. Hugh M. Smith, U. S. Commissioner of Fisheries; Dr. E. D. Clark, A. W. Hansen and H. D. Davi, of the U. S. Bureau of Chemistry; Frank L. Gorrell, Secretary of the National Canners' Association; Capt. E. E. Hahn, of the U. S. Bureau of Fisheries; John G. Ruge, of Apalachicola, Florida; N. B. Scofield and his assistants of the California Fish and Game Commission; and the various Superintendents of the Alaska Packers Association.

I am especially indebted to my wife and daughter for the practical testing and working out of certain processes given in the work, more especially those relating to secondary products, and also for much valuable assistance in other lines.

Many of the illustrations are from the exceedingly valuable collection of the Pacific Fisherman of Seattle, Wash., while others were made from photographs taken by the author. The U. S. Bureau of Fisheries kindly permitted the reproduction of drawings of certain fishes from its large and valuable collection.

JOHN N. COBB.

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March 1, 1919.

INTRODUCTION

THE canning of food products in the United States is now one of the great industries of the country and many of the products so prepared are shipped to all parts of the known world. But few of the present day canners appreciate the tremendous handicaps which the early operators labored under. At that time the science of bacteriology, now of such great importance in the industry, was practically unknown, while the mechanical appliances for the making of cans and the packing and processing of same, now so universally used, were practically unknown, and were developed only after long and costly experimenting.

For many years the consumption of these products was seriously hampered by a strong prejudice on the part of many people against canned foods. This was due partly to the veil of secrecy which was, up to within a few years ago, usually thrown around the operations of canneries. Most packers were groping largely in the dark and feared that their competitors might discover and appropriate their discoveries, or that the public might learn of their failures, hence high board fences, locked doors, and "Positively No Admission" signs were common around and on canneries, and naturally the public jumped to the conclusion that they were engaged in some nefarious practices which necessitated such precautions.

As time went on, and the why and wherefore of many problems which had hitherto barred the way to success became clearer, canners began to see things with a more enlightened vision, and, feeling the need of a freer interchange of views on matters connected with the industry, and especially to combat and overcome the prejudice then existing to a considerable extent on the part of the great consuming public, began organizing associations covering certain branches of the industry, or certain limited territory, and these efforts finally culminated a few years ago in the formation of a nation-wide organization known as the National Canners Association, which has been a wonderful power for good since its inception. At the meetings of these organizations a free interchange of views and experiences became common, and as the packer found that his competitor was a being like himself, and had been beset with much the same problems, the old exclusiveness gradually wore away, and welcome signs began to supersede the old padlocks and "No Admission" signs so common before. The consuming public was also invited into the plants so that it might see for itself the efforts which were being put forth to pack only clean, wholesome goods. This publicity also sounded the death-knell of the unsanitary and rascally plants which had thrived under the old conditions.

The earliest experimenters in the art of canning worked quite largely with fishery products, and the history of the rise of this great industry shows these products as in the foreground for a considerable part of the time. During the last twenty years the canning of fruit and vegetables has, however, overshadowed the canning of fishery products. Several excellent works have been published on the art of canning the former, but, strange to relate, no work devoted exclusively to the practical canning of fishery products, a work which would show the canner how to actually pack his product, has ever been published.

The almost world-wide war, which raged from 1914 to late in 1918, created a tremendous demand for all sorts of fishery and other food products to make up the shortage caused by the laying waste of great sections by the warring armies, and the withdrawal

from productive operations of many who had hitherto labored in the fisheries, etc. While the demand for fishery products will not be so insistent now that peace has come, yet a large part of it will persist, as the consuming public has become thoroughly familiar with the wholesomeness and cheapness of these as compared with meat products.

In addition to describing the methods followed in canning the fishery products now before the public, an effort has been made to describe certain species which are suitable for canning, but which have hitherto been neglected for various causes, and to show the processes which would be most likely to succeed in their handling and packing. The available supplies of these species, when and where they are to be obtained, and the best methods for catching them, are also described. In this the author has not confined himself to the United States, but has included, so far as possible, species which are found also in Canada, Mexico and Central America.

The practice of the U. S. Bureau of Fisheries in including under the head of fishery products all animal and plant life taken from the water by means of apparatus operated from a boat, has been followed in this work.

HISTORICAL

CANNING, as here exemplified, is the art of preserving a food product in hermetically sealed container, the preservation being accomplished through sterilization by means of heat. The object is to retain the food in as nearly a fresh condition, or in the condition in which it is usually consumed, as possible. In this way it is possible to have wholesome vegetable, meat and fish products at all times, and in places far distant from the source of supply, or where otherwise the cost or the labor of preparation would be prohibitive.

The art of preserving food by pickling, drying and smoking, is as old almost as the earliest pages of recorded history, but it is only a little over a hundred years ago that the art of canning had its beginning.

The credit for the discovery of this method is almost universally assigned to Nicholas Appert, a Frenchman. Near the end of the eighteenth century the French government offered a bounty of 12,000 francs for an improved method of preserving foods, the object being to secure better quality and to reduce the loss in wastage and spoilage in foods used in military and naval stores. Appert worked from 1795 until 1804 before he attained any considerable measure of success, which consisted in heating the product and then hermetically sealing the container. Encouraged by this he continued his efforts, using many different substances, and succeeded so admirably that in 1810 he published the results and was rewarded with the prize:

The method of Appert was essentially as follows: The products, which in some cases were partly cooked, were packed almost to the top in glass bottles, sufficient water added to cover, the bottles corked loosely and placed to their necks in tepid water, the heat being raised gradually to a temperature between 190 to 200° F. (88 to 94° C.) in the center of his bottles, the maximum being 212° F. The length of the cooking depended upon the character of the food, and varied generally from 30 to 60 minutes. The bottles were then corked securely and allowed to cool slowly in the bath.

In 1807 a Mr. Soddington presented a description of a method of preserving to the English Society of Arts. "A method of preserving fruits without sugar, for house or sea stores,"* the essential features of which were that the fruits be placed in glass bottles, loosely corked, put in a water bath at 165° F. for one hour, then boiling water added to cover the fruit, the corks driven in, and the bottles laid on their sides so that the hot liquid might swell the corks. He did not claim to be the originator of the method, and it is believed that the general principles were obtained by him while traveling in France.

Appert thought that the exclusion of outside air after applying sufficient heat to the food was the reason it kept when treated according to his method, and for some years those who followed him also fell into the same error. It was not until the advent of the new science of bacteriology that the true explanation was found. It is now known that all foods, water, air and the containers, are bearers of bacteria and other micro-organisms; that the effect of the heat is to destroy them, and that the hermetic container merely excludes those from without. This science has also shown that all organisms are not killed at the same temperature; that some spores possess great resistance, and that some products bear types of organisms which are more resistant than others. The spores of some bacteria are able to sustain life after continuous boiling for from 6 to 10 hours, but

*Hassell: Food and Its Adulterations, London, 1845, p. 432.

all spores as yet examined are destroyed at a temperature of 250° F. if this temperature be applied to them for 20 minutes. This heat must come directly upon the spores, and to this fact is due the difference in time and temperature required to process different foods.

Appert's discoveries were soon applied commercially on a small scale in Europe, but it was not until the substitution of tin cans in place of glass bottles was successfully accomplished that the general process of canning was extensively applied. These seem to have been first used in 1820, and in 1823 a patent for them was issued to Pierre Antoine Angilbert. Preserved fish had been placed in tin cans for many years previous, but not in the manner known at present as canning.

Angilbert's method was very similar to the process in vogue up to the introduction of the sanitary can. A definite amount of the article to be preserved, with some liquid, is placed in a tin can, over which the cover, containing a minute hole, is soldered, and the can and contents are placed in a bath of boiling water. Through the small hole the air and steam escape from the can in boiling, and the heat also kills the bacteria. The hole is closed with a drop of solder, and the process of cooking is completed.

Ezra Daggett and Thomas Kensett are credited with having introduced the art of canning into this country. In 1819 they packed some salmon, lobsters and oysters in New York. The next year William Underwood and Charles Mitchell packed fruit in Boston. These pioneers had learned the methods before emigrating to this country. Edward Wright packed oysters at Baltimore between 1838 and 1840. The late Thomas Kensett, who is supposed to have started the industry there, is said not to have begun canning oysters until about 1844. In 1841, Charles Mitchell is said to have opened a cannery at Halifax, Nova Scotia. It is particularly noteworthy that nearly all of the pioneer factories started on fishery products as the primary pack, and fruits and vegetables as incidental.

In 1839 Upham S. Treat, of Eastport, Maine, engaged in packing salmon at St. Johns, N. B., and he claimed that he sold the first canned salmon that was ever sold in this country. In 1841 he removed to Eastport, Maine, where the firm of Treat, Noble & Company was formed, composed of Treat, Isaac Noble and Tristram Halliday, and engaged in packing lobsters and salmon. In 1843 the firm secured the services of Charles Mitchell, who had established the cannery at Halifax in 1841; the same year Treat withdrew from the firm and the business was carried on by Noble and Mitchell, Halliday apparently having dropped out at some unknown period. In 1843 the Eastport plant made the first pack of canned mackerel ever prepared. About 1845 Noble & Mitchell sold out to William Underwood & Company.

In 1843 the firm of W. K. Lewis & Brothers put up some goods in Boston, and in 1845 started a factory in Portland, Maine, on Custom House Wharf, preserving mostly fish and meats.

In 1849 Henry Evans, who had been a pupil of U. S. Treat at Eastport, had a packing shop on Custom House Wharf, Portland, but he continued in business here only about a year. The same year Aaron Ring opened a cannery in Portland, packing lobsters, meats, etc., on Burnham's Wharf, and was packing as late as 1854.

In 1852 the firm of Rumery & Burnham, composed of Samuel Rumery—who had learned the trade at Eastport with Treat, Noble & Co., and had been connected with various packing companies subsequently—and George Burnham, Jr.—who had learned the trade with Lewis & Co.—established a cannery at Portland. Their principal business was at first the packing of fish, clams, lobsters, meats and poultry. In 1867 the firm was

dissolved and was succeeded by the firm of Burnham & Morrill, which continued until the early 90's, when the business was incorporated as Burnham & Morrill Co.

The first salmon was canned at Aberdeen, Scotland, in 1824. Later on a few were canned in Maine and New Brunswick, but the industry did not become of consequence until canning was begun on the Sacramento River by Messrs. Hapgood, Hume & Co. in 1864. Finding the run of fish here somewhat disappointing the company, in the spring of 1866, sent William Hume to prospect the Columbia River, and shortly after he started a cannery at Eagle Cliff, Wash., about 40 miles above Astoria.

The first salmon cannery in British Columbia was established by Ewen & Wise at New Westminster, on the Fraser River, in 1867, while Jackson, Myers & Co. erected the first salmon cannery on Puget Sound, Wash., at Mukilteo in 1877.

Alaska is now the greatest producer of canned salmon, but it was not until 1878 that the first cannery was established by the North Pacific Trading & Packing Co., at Klawak, on Prince of Wales Island.

Today salmon canning is the most important fish canning industry of the Pacific coast or of the country.

The sardine industry was established at Nantes, France, about 1834. Efforts were early made in this country to find a substitute for the popular French sardines. In 1871 a plant was located near Port Monmouth, N. J., by the American Sardine Co., and the immature menhaden were packed as sardines. In 1875 the canning of young herring as sardines began in Maine, and rapidly supplanted that of the menhaden. Early in this century the industry was established on the Pacific Coast, where it now is of much importance.

The first clam cannery in this country was established at Pine Point, Maine, near Portland, by Burnham & Morrill, about 1870

The first shrimps were canned by S. W. Dunbar & Sons at New Orleans, La., in 1875. The first crabs were canned by James McMenamin, at Norfolk, Va., about 1878. Tuna were first canned in Southern California in 1907, by A. P. Halfhill.

LOCATION AND EQUIPMENT OF PLANT

LOCATION OF PLANT

THIS is one of the most important matters to be considered by anyone contemplating going into the canning business. The first, and most essential point, is to secure a location on the shore in as close proximity to the fishing grounds as is possible, regard being had also to its proximity to shipping facilities either by rail or water. If on tidal water care should be exercised to see that there is water enough to permit of vessels lying alongside the dock during some or all stages of the tides. A big saving in money and time will result if vessels can lie alongside the dock and load or unload at all hours of the day or night.

The plant should be, if possible, located over the water. This will prevent the possibility of the space under the buildings becoming contaminated with refuse and waste thus forming a breeding place for various bacteria which might do incalculable injury to the pack.

If this is not possible, the plant should be on high ground, having good natural drainage. In this event, in order to prevent water and waste lodging under the factory, the cannery and fish house at least should be provided with water-tight floors, sloped to gutters, emptying into drains which convey it away from the building.

WATER SUPPLY

The next important point is an adequate supply of pure, cold water. This should be introduced into the cannery through large mains, tapped at places convenient to the work. It is false economy to economize in the use of water, and the mains should be large enough and the pressure great enough to permit the water to be drawn simultaneously at several different points without materially lessening the flow at any one. A generous water supply will also be invaluable in case of fire.

It is well to have several elevated water tanks in which a reserve supply may be stored, so that in case anything happens to cut off, temporarily, the regular supply line, it will not be necessary to shut down the plant, which may entail a heavy money loss should it occur in the height of the packing season.

Many canneries located on the shores of streams and bays have a short line to the deeper water, and by connecting this up with the pump are enabled in case of breakdown of the regular water line, or a scarcity of water, to secure ample water to use in washing down and for other rough work in the cannery and fish house.

LABOR

The one advantage of locating in the neighborhood of a town or city is that all the resident labor necessary to conduct the more important and responsible operations of the cannery will be available, while sufficient floating labor can be obtained for the rougher work and during times of extraordinary rush. In fish canning labor saving devices have been brought to a high state of efficiency, so that it is not necessary to have more than a few skilled workers on hand. The bulk of the help is unskilled, but it should be such as the canner can depend upon. Nearly all canneries have to import help during the rush season, but for this very reason it is difficult to secure good help when wanted.

The fishing business is one of gluts and famines, the fish being either abundant or almost, or entirely, wanting at times, and should the labor not be available to handle it in times of glut the raw material spoiled may in a few days eat up the profits of the entire pack. If an attempt is made to "work up" the surplus it will be necessary to do night work, and while this can always be counted on as a certainty during the busy season, it becomes a source of much trouble to the management if it is too frequent. In times of glut the work is strenuous and the help, after putting in a full day, are not eager to work in the evening. Extra wages for "overtime" several evenings in the week are sufficient to induce most of them to work, but if more is attempted they are apt either to slight the work of the next day or remain away altogether.

SANITATION

The rough-boarded, unpainted cluster of buildings which once masqueraded as a canning plant is but rarely ever seen in these modern days. The modern cannery is built either of corrugated iron or wood, with iron or shingle roof. On account of the fire hazard the former type is rapidly predominating. Designed with an eye to beauty, as well as convenience in operating, most owners take a pride in beautifying the surroundings, and in the case of fish canneries, which are usually located on the shores of rivers or bays, this is not difficult.

In the modern plant the ceilings of all rooms should be high, with ample provision for light and ventilation. Owing to the steam from the exhaust boxes there should be ample ventilators in the roof for getting rid of this as speedily as possible. Light has a beneficial effect upon employees, contributes to cleanliness, and is an active, constant disinfectant. An abundance of light and air is a combination which will contribute to the maximum of labor efficiency.

The best floor for the cannery proper is of Portland cement. When properly finished as to surface it is practically impervious and may be easily cleaned with a hose. It will be hard enough to enable the setting of ordinary machines directly upon it, and it will indefinitely resist wear due to walking upon it. Much water is used in fish-canning plants, and as a result careful attention should be given to the grading of the surface of the finished floor. The grade should be not less than one-eighth of an inch to the foot, and the length in any direction should not be more than 16 feet. Where it is necessary that some water should run over the floor where persons are working, a good plan is to form half-round grooves, one inch wide, 4 inches center to center, in the surface of the floor, and these will carry off the greater part of the water, thus giving a reasonably dry working surface.

If the floor is of wood it should be watertight, sloped to gutters emptying into drains, for carrying off the water and waste. It is very difficult, if not impossible, to keep them water-tight, especially in canneries which are idle part of the year, as the wood shrinks, swells and cracks with changes of moisture, the cracks are hard to clean, while leakage is almost certain to occur. Upper floors should not be chosen for food preparation if plenty of ground space is available, for the reason it is difficult to keep them tight.

Slat gratings are frequently used to cover the floor in places where there is a splashing or overflow of water. These may be made in sections about 2 by 4 feet, and can be taken up for cleaning. There is no excuse for floors being so wet or sloppy that the workers must wear rubbers, which is sometimes the case. No crew which has to slop around in water while working is ever contented.

All side-walls, partitions, ceilings and supports should be smooth, to admit of easy cleaning. Preferably they should be light-colored and, so far as possible, of such material as can be washed with a hose, as this is the easiest method of cleaning or of applying whitewash. That part of the factory in which prepared material is in any way exposed should be screened to keep out flies and dust.

The tables used in the various stages of canning should be plain and of a material that is easily cleaned. Hardwood is the best material for the majority of plants, as they will absorb little water or slime, and clean easily with soap, water and scrubbing brush. The machinery used should be of the most sanitary type and set in such a manner as to be accessible from all sides for cleaning. Water and steam pipes, with hose attachment, should be conveniently placed about the plant for cleaning tables, machines, floors, walls and ceilings.

In the modern cannery especial provision is made for the cleanliness and comfort of the employees. Sinks, with running water, should be placed at convenient spots that the workers may wash their hands often, and sanitary drinking fountains installed to take the place of the common cup. Proper toilet and clothes rooms (where employees may change from street to working clothes and vice versa) should be provided, and the latter should have lockers in which the clothes can be stored, as wearing apparel should not be hung about the plant. Some plants provide special suits for its employees, and manicurists to keep their hands in order. Stools should be provided such employees as do work which can be performed as well sitting down as standing up. Wooden spring-boards should be provided those employees who have to stand in one place upon a cement floor. The various states now fix the general conditions under which labor may be performed, as age limit, number of working hours in the day or week, and physical condition. No person affected with a skin disease should be employed in a food factory.

The following requirements adopted by the National Canners Association for the operation of sardine canneries, will give an idea of the stress now laid upon sanitary conditions in such plants and might be profitably employed by other canning plants:

PRELIMINARY REQUIREMENTS FOR OPENING OF SARDINE CANNING SEASON

1. The walls should be thoroughly cleaned and painted or whitewashed.

2. The floors should be thoroughly scraped and scrubbed until clean. They should be made tight to prevent accumulation of dirt in cracks and to make it possible to keep them clean. Packing tables, machinery and all utensils should be thoroughly washed or cleaned.

3. Separate toilets should be provided for each sex. The floors should be tight so that they can be readily cleaned. Unless provided with a flushing system they should be separate from the cannery. They should be screened, well lighted and ventilated. Sanitary toilet paper should be provided.

4. Adequate lavatories adjacent to the toilets should be provided, with soap and clean towels.

5. Suitable provisions should be made for the removal of refuse daily and to secure proper drainage in connection with the cannery.

REQUIREMENTS DURING CANNING SEASON

1. Canners should see that the requirements contained in the circular letter of April 8th, addressed to the fishermen and boatmen, are lived up to, covering the quality of the fish.

2. Canners should see that the fish boats bringing the fish to the canneries are kept clean and sanitary and provided with tight tanks.

3. When fish are brought from a considerable distance, the last fish out of the boat, being in poorer condition, should be packed first, assuming of course that they are suitable for packing.

4. The pickling brine should be changed daily or after each operation.

5. The flakes should be clean. A pair of revolving brushes and cleansing powder, consisting of a mixture of carbonate of soda with a little caustic soda, are suggested for this purpose.

6. The racks should be scrubbed often enough to be kept clean.

7. Steam boxes and dryers should be kept clean.

8. Flaking machinery and other machinery should be cleaned daily or after each operation.

9. Tables should be washed clean daily or after each operation. In case of wooden tables, the tops should be free from cracks and preferably of hard wood.

10. The pans should be kept clean. They should not be stacked on top of each other in such a way that the bottom of the pan can come in contact with the fish in the cans below.

11. Fry baskets should be kept as clean as possible.

12. "Mush" pans should be emptied and cleaned daily or after each operation.

13. The water in bath tanks should be changed daily or after each operation.

14. The floors should be cleaned daily or after each operation.

15. The toilets should be provided with sanitary toilet paper and should be kept clean.

16. The lavatories should be kept clean and provided with soap, clean towels and running water. They should be separate from, but near, the toilets.

17. The hands and nails of employees handling fish should be kept clean. Employees should wash their hands before beginning work and after leaving the toilet.

18. The employees should wear washable clothing or aprons and change them frequently. Women should wear caps over their hair.

19. Spitting on the walls or floors of canneries should be prohibited. Cuspidors should be provided, if necessary, and should be kept clean. The use of tobacco by employees should be discouraged in the canneries.

20. The cans in which the fish are packed should be clean and should be stored in such a manner as to avoid contamination. The filled cans should be cleaned before packing for shipment.

EQUIPMENT OF A CANNING PLANT

The proper equipment of the plant is a most important consideration. A poor equipment, or one that is out of date, not only increases the cost of packing, but also is a hindrance in the production of best quality. As the raw material for fish canneries would come over the fish dock it is essential for economical operation that it be so handled that there will be no costly back steps.

When the fish reach the cannery dock they should be raised from the boat to the dock in an elevator, or in baskets or boxes. In handling large species the pewing of the fish, which causes unsightly holes in which the blood congeals, should be prevented by employing unloading scows. In these the fish are allowed to slide from the scow through a gate in the side into the hopper of an elevator, which carries them up to the fish dock. A few cannerymen run the elevator to a point some distance above the floor of the dock, and by constructing in the fish house a false floor so arranged that the sides all slope toward the center and the fish cleaning machines, the whole being raised sufficiently that the fish will naturally slide to and down this chute onto a table where they may be dressed, or fed to a machine to be used for this purpose, or to an endless belt that will carry them to dressing tables or washing tanks, save much pewing and handling on the fish-house floor. Should the fish become dry on the outside and stick during this operation it is only necessary to turn a hose on them for a few minutes when the moist slime will cause them to slide freely.

The improvement of conveying machinery in recent years has been marvelous, and the canner will find it economical to introduce such wherever possible, as the saving in labor alone will be considerable, while it will also cut down to a minimum the direct handling of the raw product by the workers, a thing much to be desired.

With a proper arrangement of the plant the material ought to move steadily forward, in as straight a line as possible, from the point where it is first received until it comes from the retort ready to be trucked into the warehouse.

The various products which are to be canned generally require machinery specially constructed to do the work, and when it is known just what kind of goods are to be prepared, it is a matter of judgment to determine what machines are best for the purpose. There are machinery manufacturers who have special lines for the canning of all regular products, and any of these would gladly submit detailed estimates of what is

needed, including also, if desired, the pulleys, belting, piping, etc. Should the product be a special one, machinery may have to be built according to the packer's idea for this particular work.

In buying machinery the canner should make absolutely sure that it will be ample to take care of all the raw material received as rapidly as possible. It is not wise, nor economical, to run full with no reserve machines to take up the work in case of breakdowns.

BOILER CAPACITY

A good boiler of ample size should be installed as a plentiful supply of dry steam is a very necessary requirement. Aside from the initial cost, it is much cheaper to instal a boiler of nearly, or quite, double the capacity that you anticipate using. A small boiler, taxed beyond its capacity, is more likely to break down at critical moments, while it will consume more fuel in proportion, and much of the time will deliver wet steam. A plan followed by many plants is to have a battery of two boilers, each of sufficient size to run the factory to its full capacity. The extra cost of two is more than offset by the fact that the disabling of one will not cause a shut-down of the plant, which, if occurring in the height of the run, would prove financially disastrous. They should, of course, be run as a battery, not singly, thereby obtaining virtually the same advantage as from one large boiler. When possible the steam plant should be in a separate building, as this would materially reduce the fire hazard.

CONTAINERS

The tin can is preeminently the container used in commercial canning, and has been so almost from the inception of the industry. The tin can has undergone a number of changes. The first cans had flush sides and ends, or plumb joints; these gave way to the stamped-overlapped ends, and all inside solder has been superseded by lock seams and outside soldering. Most solder caps are hemmed, so that only the amount necessary to seal is used. The solder can has been superseded in most fish canneries by the open-top, or so-called sanitary can, and in this case the sealing is done by double seaming on the top, no solder being used on the can except in making the side seam. The former objections to acid and solder, on the ground that they contaminated the foodstuffs, have thus been largely overcome.

Tin cans are classed as open-top and hole-and-cap. Cans are known as key-opening if some part of the can has been sufficiently cut to permit opening by stripping a part out of the side or top by means of a key; these are generally packed with sardines.

With certain products, such as lobsters, shrimps, crabs, etc., it is necessary to keep the product from coming in direct contact with the tin, and this is accomplished by either lining the inside of the can with wood, parchment paper or cloth, or by coating or lacquering the inside. The latter type of can is known as the "enamel-lined" can. Various coatings have been tried at different times without entire success, and while the present lining is not perfect, it does effect a marked improvement in many lines of packing. This enameling is accomplished in two ways—by baking the lacquer on the sheet and by spraying it on the inside of the finished can.

In the salmon industry many of the companies, and especially those operating in the more remote sections of Alaska, manufacture their own cans. This is due largely to the fact that less freight space is occupied by the tin plate in sheets than by the manufactured cans. The companies also have to take up large crews to pack the fish, and these

can be employed in making the cans during the interval between arrival at the plant and the appearance of the fish. However, the question of freight space saved is overcome by a recent improvement in can-making, by which the can bodies are made, then flattened out, and upon arrival at the cannery are run through a machine which shapes them once more so that the ends can be put on.

A number of can-making factories are now located within reasonable shipping distance of many of the canneries and furnish the packer with his cans, these usually being shipped in regular shipping boxes.

Tops are made separately and most of the canneries which make their own cans usually purchase the tops from the regular can factories.

There are a great variety of shapes and sizes of cans, and one can get a product in almost any weight from $\frac{1}{8}$th ounce to about one gallon. This anomalous condition has developed in three ways. First, the cans were made to utilize a standard sheet of metal with the minimum of waste by the method of can-making in vogue at the time. This resulted in cans of arbitrary volume, bearing no definite relation to standards of volume, like the pint, quart or gallon, and these arbitrary sizes have persisted because of becoming a fixture in trade, and the expense in changing machinery, cans, shipping cases, etc. Second, was the introduction of sizes to fit a given weight of a certain product; this is particularly true of meat products. The shapes have also been changed to enable perfect packing of a certain product. Thirdly, is the attempt to make cans that will hold a quantity of a given article to retail at a popular price, like 10 cents. This applies particularly to soups, etc.

Canners of fishery products have been as great offenders along these lines as any of the others, particularly those packing oysters and clams.

In 1913, in an effort to standardize can sizes, the National Canners Association agreed upon the following sizes, and these are in use for many products:

Hole and Cap Cans—	Diam. Ins.	Height. Ins.	Sanitary Cans—	Diam. Ins.	Height. Ins.
No. 1 size	$2\frac{1}{8}$	4	No. 1 size	$2\frac{1}{8}$	4
No. 2	3^{3}_{16}	4^{9}_{16}	No. 2	3^{7}_{16}	4^{9}_{16}
No. $2\frac{1}{2}$	4	4^{3}_{4}	No. $2\frac{1}{2}$	4^{1}_{16}	4^{3}_{4}
No. 3, 4^{7}_{8} inches	4^{5}_{16}	4^{7}_{8}	No. 3, 4^{7}_{8} inches	4^{1}_{4}	4^{7}_{8}
No. 3, 5 inches	4^{1}_{4}	5	No. 3, 5 inches	4^{1}_{4}	5
No. 3, $5\frac{1}{2}$ inches	4^{1}_{4}	$5\frac{1}{2}$	No. 3, $5\frac{1}{2}$ inches	4^{1}_{4}	$5\frac{1}{2}$
No. 10	6^{1}_{4}	6^{3}_{4}	No. 10	6^{3}_{16}	7

Glass jars are coming into use for certain fishery products, and all that prevents their more general use is that they break easily, cannot be handled by automatic machinery, will not stand hard processing without special precautions, and cost more in freight rates. Against these objections may be set forth the fact that they make a much cleaner and neater package, and also display certain products to much greater advantage than any other type of container. Of recent years great improvements have been made in glass jars and the methods of sealing, which may cause a wide expansion of their sphere of usefulness in canning.

STOREHOUSE FOR EMPTY CANS

The empty cans should be stored in a building protected from dampness and steam, and preferably on the second floor, as they will then be at such an elevation above the filling machines and packing tables that they can be delivered in properly constructed chutes, by gravity, to points where they are to be filled. When storing cans in bulk in bins, lay on side in even and regular tiers, keeping cap end to cap end, or start with the first tier cap end out, the balance with bottom out. When stored in shipping case, place the bottom layer cap end up, and the top layer cap end down.

METHODS AND PROCESSES

THE steps in canning will vary with the product, but, in general, there are certain features which are common to all, and may be described in this outline, as receiving the product, washing and dressing, preparing for the can, filling, exhausting, capping, processing and cooling. The more intimate details will be found in full under the various products enumerated.

RAW MATERIAL

It is essential that the raw product be delivered fresh and in first-class condition at the plant. When possible it should be packed in ice, and in compartments or boxes to avoid bruising and excessive pressure. The nearer the cannery is to the point of production the better will be the finished product. Fishery products spoil easily and quickly if not properly handled, so great care should be exercised at all stages. It should never be forgotten that if the raw material is not fresh and wholesome, canning will not improve it in the slightest; it can only suspend the deterioration of the product while the latter is in the hermetically sealed package.

GRADING

At most plants the products are graded according to size, species, and sometimes as to color of flesh. This should be done in the fish house by men who are trained to this work. A mixing of the different grades in the same case may cause rejection of a large shipment by the buyer's agent, this sometimes entailing a heavy money loss, and frequently creating a prejudice in the buyer's mind against all of the seller's products.

WASHING AND DRESSING

This operation is one of the most important in the factory. Fish are usually given a washing with the hose before being dressed. This is especially true with salmon, which are protected by a heavy coat of slime. Salmon are split, the entrails removed, and the head, tail and fins cut off in a machine known as the "Iron Chink." An improved type of this machine, and another special machine, is used to "slime" the fish and more thoroughly clean out the abdominal cavity. Many fishery products are, however, dressed and cleaned by hand. Great care must be exercised to make sure of all blood being removed from around the backbone, and to insure this and for general cleaning each operator has an individual faucet playing constantly upon his dressing board or bin. Many of them have a short piece of hose attached with which to give the fish an even more thorough cleaning. They are then washed in tanks filled with either cold fresh or salt water, or brine, varying with the different products to be handled.

The larger dressed fish are then cut into can lengths by hand or machine, while the smaller fish are usually handled without cutting.

In filling the product into the can the cut pieces are put in by either hand or machine, while the small ones, such as sardines, are usually put in by hand. In most canneries the cans come down from the second floor in a chute and just before reaching the filling machine the quantity of salt needed for taste is put in by an automatic device. The methods of filling are described in detail under the different products. Filling machines have been vastly improved of recent years, and most of the work is now done with nicety and precision. All filling machines operate upon the principle of deliv-

ering a certain volume rather than a given weight, and for the fishery products handled in this way this method is very satisfactory. In all cases, whether the can be filled by weight or volume, the amount of material used should be all that can be put in the can in first-class condition. Some packers insist, and justly, that the best results are obtained by hand packing, but in regions where labor is scarce the filling machine is a necessity.

In filling the cans head space equivalent to one-eighth to one-fourth of an inch should be left. The amount of head space needed depends in a measure upon the nature of the product, but without some space the production of a small amount of gas will destroy the vacuum. In the hole-and-cap cans this space is available, because the sealing cannot be done without some room, and as a result springers are rare. The tendency is to over-fill the open-top cans. The later types of sanitary capping machines are provided with plungers to squeeze down solidly the contents of the cans, but care must be used in packing a solid product like fish not to overfill.

EXHAUSTING

After the cans are filled they should be exhausted, that is, heated until the contents are hot and as much as possible of the air driven out. This process is not considered necessary for articles that are subjected to previous cooking, or for those that are filled hot, or which receive a hot brine or other dressing, although it is advantageous even under these conditions and is quite generally done. Despite the belief of many canners, exhausting has little to do with sterilization, but it does aid in relieving the intense strain upon the cans in the final process; also if the air be not driven out there is not the proper collapse of the can, and it may be difficult to tell when spoilage occurs. Another important reason is that it lessens the attack of the contents upon the container.

The exhausting of cans previously capped may be accomplished by piling the metal coolers, or trays, containing the cans on a truck and placing it in a steam box, where they are subjected to the action of steam at a very low pressure for a specified time, or by placing them one tier deep in a shallow crate and submerging in a tank of boiling water, or running them through a tank of boiling water on an endless belt, removing after the directed time has elapsed and tipping as quickly as possible thereafter. In this connection it must be noted that from the time the cans are exhausted by any method they must be kept in speedy and constant motion until in the process retort. This is the danger period when germs—bacteria which are not destroyed by the final process—are developed in the goods or absorbed from the air. To overcome this danger most fish packers now use a long, tight box with open ends, into which live steam is vigorously injected, and through which the cans travel back and forth on endless belts a number of times before finally being ejected at the opposite end. A long exhaust is given as fish conducts heat quite slowly and there is usually but little free liquid in the cans. Some salmon canners exhaust as long as 20 minutes, but 15 minutes is the average time. Exhaust boxes employing revolving spirals, designed mainly to conserve space, and various other types, have been invented and used more or less. The temperature required to properly exhaust is usually from 210 to 212° Fahrenheit.

Fishery products are usually capped loosely before exhausting, as it was found when the cans passed through the exhaust box with the tops open that the steam condensed upon the fish, making the product unattractive, while the exhaust box was littered with pieces of fish lost from the cans during their passage.

In recent years mechanical methods of vacuumizing have been coming to the fore. One machine which has been tried in salmon and tuna canneries has given excellent results. At present the vacuum on this machine is made suddenly and is acting for

only about two seconds. This is possible on certain fishes because being without a free liquid there is nothing to obstruct the passage of the air from the can to the chamber. Where brine, water or oil is concerned the machine is apt to cause some of the liquid to be expelled. It is probable that the machine will ultimately be so improved that products with much free liquid can be exhausted properly in it.

Ordinary cans have a partial vacuum of from 6 to 8 inches, those well exhausted 10 to 13 inches, and those very well exhausted up to 22 inches.

TOPPING

Open-top cans, which are the kind in general use by fish canners, are sealed by a special machine known as a double seamer. The lid is pressed into place and steel rollers crimp it on without acid or solder. This action is automatic, a single can at a time, but at the rate of 30 to 120 per minute, depending upon the type of machine. Cans with solder tops are sealed by automatic machinery, 12 at a time, 85 per minute, or 5,000 per hour. The top is wiped, the cap placed on, acid applied, the hot soldering irons drop into place, and the vent is afterwards closed, all in one series of operations, without touching by hand. But few fish canneries now use solder-top cans. When they do the cans generally go from the capper to the hot water tank, where they are tested for leaks. Any imperfection in the can or defect in sealing will be shown by a series of air bubbles issuing from the opening, and the can is taken out for repairs.

TIPPING

Tipping is not much practised by fish canners nowadays, the sanitary can having quite generally eliminated the necessity for it. With a few products, however, the cans are tipped after they come from the soldering machine. In the case of certain fishery products packed in the old style way the cans are vented after coming from the steam exhaust box and tipped again immediately.

TIPPING A TIN CAN

When tipping cans have the flux jar and brush conveniently at hand, dip the brush in the flux and strike the venthole a side stroke lightly with the brush saturated with flux. Place the point of the wire solder over the venthole. Place upon this the point of the hot, bright, tipping copper. Press down with a rotary motion and remove quickly.

PROCESSING

Processing is the sterilizing or cooking of the foods contained in hermetically sealed packages. This work may be performed in any vessel of suitable dimensions that can be provided with a constant and easily regulated supply of either boiling water or steam under pressure during the period necessary to cook or sterilize the product.

For products which do not require a temperature exceeding 212 F., wooden or iron tanks, round, square or rectangular, with perforated coils or crosses in the bottom for the introduction of jets of live steam to boil the water, are in use and this is known as the "open-bath process."

For substances requiring a temperature of more than 212 F. (most fishery products do), and when it is desired to hasten the operation with those requiring less, iron tanks, or retorts, of various shapes, round, half round, square or rectangular, placed either horizontally or perpendicularly, and fitted with doors which can be clamped and made steam tight, are used, and this is known as the "closed process." Horizontal retorts,

which are used quite generally for fishery products, are worked with dry steam as a cooking medium. Upright retorts, which are employed for a few products, may be used with dry steam or with water and steam, as preferred.

In addition to the steam inlet, retorts should be provided with a top steam exhaust, bottom waste and safety valves; also bath thermometers and steam gauge. The pressure in these retorts will vary from 5 to 15 pounds, thus giving temperatures from 220° F. (105° C.) to 255° F. (124° C.).

In the open-bath process the kettles should be fitted with a compartment for holding a thermometer, and this compartment should be fitted with a pet cock at the top or bottom so as to insure a perfect circulation around the thermometer end. Unless this is done there is a possibility of the compartment being "dead" and so show a false register on the thermometer. The pet cock should be kept at a slight crack, so that a thin emission of steam will always be apparent.

It has been well established that the thermal death point of all spore-bearing bacteria is 250° F. if this temperature be applied directly to them for 20 minutes. This means that when the entire contents of the sealed packages are heated to this degree the sterilization is complete and the goods will be preserved indefinitely. From the above it would seem that the processing is merely a question of getting the temperature noted above and holding it for the time stated in order to avoid any chances of future spoilage. Unfortunately this temperature is entirely too high to give all foods, in fact the higher the temperature in general the poorer the appearance of the finished goods. (The principal reason temperatures approaching 250° are used in processing fishes is for the purpose of softening the bones.) For this reason it becomes extremely desirable for every canner to know exactly whether the particular pack has been properly put up, and what is the lowest possible temperature and the shortest possible time that he may safely use in his process. There is absolutely no way to answer this problem except by experiment—every day's run ought to be tested; in fact, every coolerful should be tested, if possible, and the process determined by this method only. As long as spore-bearing bacteria are present and likely to contaminate canned foods in the water or in the factory, it will be impossible for any one to recommend a satisfactory and infallible processing time and temperature that will not only be safe for a certain canned food, but commercially profitable as well.

When processing in an open bath fill the kettle about half full of water, or sufficient to cover the cans, and bring to a boil, shut off steam, lower the filled crate in kettle by any mechanical means, throwing the bails of lower crate on side; turn on full head of steam and when the water boils, the thermometer marking 212°, make note of the time; cut the steam down, leaving valve open just enough to keep up a lively boil; when time directed has expired shut off steam and remove crates from kettle.

Should a higher temperature than 212° in an open bath be desired, or where the altitude is such that water boils at less than 212°, the result may be obtained by using a solution of chloride of calcium instead of water and heating with a closed coil instead of the usual perforated coil or cross. The rest of the process is the same as above after desired temperature has been attained.

When processing in a retort with steam provide an overflow pipe in connection with the bottom outlet of such a height that the steam inlet will be covered with 1 inch to 2 inches of water, thus supplying wet steam, which will not scorch or discolor the product as will dry steam under any considerable pressure. Close the bottom exhaust, run the cars in on the track, close the door and fasten the clamp or clamps opposite the hinge, then back in order, securing the clamp next the hinge last; open the top exhaust

valve and turn on steam; when the steam issues freely, nearly, but never entirely, close the top exhaust. This allows the escape of gases formed and creates a certain amount of circulation of steam in the retort. It is claimed by some packers that if the retort is closed absolutely tight a gas is formed which envelops each can and, acting as a non-conductor of heat, prevents the full action of the steam on the contents. The bottom valve is then opened just sufficient to allow the condensed steam to escape. When the thermometer marks the temperature desired, take the time, then regulate the steam with valve so that this temperature is maintained. When the process time is ended shut off steam, open both upper and lower exhaust valves, and when gauge shows no pressure loosen clamps, reversing the action observed in closing, the clamps next the hinge being loosened first and those opposite last; throw back door and run cars out. Some canners insert in the door a pop valve, sensitive to a half pound and set to blow off at a quarter pound more pressure than the process temperature demands.

When processing in a retort with water and steam, close bottom outlet and fill retort half full of water; bring to a boil; shut off steam and place crates; then handle same as with steam, of course keeping bottom outlet closed.

PROCESSING GLASS

In processing glass jars either in water or direct steam, sudden variation increase or decrease of pressure or temperature must be avoided. They are best processed in water at 212° or in steam at a temperature not much in excess of this. The jars should be sterilized before filling. This may be done by placing in vessel of cool water on a stove to heat and kept hot in water until needed. If possible, fill with hot liquid instead of exhausting. After filling cans and closing same place in water of about same temperature as contents of package, and raise the temperature progressively, taking about 15 minutes to reach boiling, or 212° F. If the jars are to be processed at this temperature, then start counting the time from the moment the water starts boiling. Maintain a slow boiling for the length of time required, then turn off steam and allow the water in kettles to cool to about 180° before removing jars. Should they be taken out of the hot boiling water the glass is liable to crack should there be a cold draft in the room.

When processing with steam great care should be taken to heat slowly, especially at the start.

Glass jars may be processed in an ordinary steam exhaust box, or in an extra long continuous steam exhaust box run at the proper speed. The heating and cooling should both be done very slowly.

The percentage of loss in sealing and processing should not exceed 2 per cent., and under best conditions should be reduced to one per cent.

WARNING

Under the different products given the processing times are stated. It should be thoroughly understood, however, that these periods are the actual cooking times, and should be computed from the moment the inside of the retort reaches the temperature prescribed until the steam is shut off. About 5 minutes is required to bring the temperature of the retort to the required point, and about 5 minutes more is required at the end of the cook to bring the gauge to a no-pressure basis.

While the processing times can be considered approximately correct, the canner should not trust to them alone—as the state of the weather and the condition of the

product sometimes necessitates a change in the process—and should test the packed goods several times a day in order to check up results. Frequent tests should be made, especially of the temperature attained during the processing, for which purpose a self-registering sterilizing thermometer may be used. Cut cans frequently, noting cook, weight, color and general appearance of the goods.

Both thermometers and gauges should be frequently compared with standard instruments known to be correct. Thermometers particularly should be tested before packing is begun each year.

GAUGE PRESSURE AND TEMPERATURE

According to Kent, under ordinary conditions at the sea level the air pressure is 14.7 pounds per square inch, and steam is formed at a temperature of 212° F.; gauge pressure will give temperature as follows:

Gauge Pressure. Pounds per sq inch.	Degrees. Temperature F.	Gauge Pressure. Pounds per sq inch.	Degrees. Temperature F.
.304	213.0	8.3	235.4
1.3	216.3	9.3	237.8
2.3	219.4	10.3	240.0
3.3	222.4	11.3	242.2
4.3	225.2	12.3	244.3
5.3	227.9	13.3	246.3
6.3	230.5	14.3	248.3
7.3	233.0	15.3	250.2

Should your thermometers and gauges not agree with this table, have them tested.

ALTITUDE STERILIZATION TABLE*

Most fish canneries are located at sea level, in which event the question of altitude does not bother, but if the factory is located above sea level to such an extent as to cause trouble in the process room, first determine just how high it is, then consult the following table, and it will help to solve some of your troubles. Add time in third column to the process time:

Altitude. Feet.	Water Boils at— Degrees.	Additional Time. Minutes.
512	211	2
1,025	210	4
1,539	209	6
2,063	208	8
2,589	207	10
3,115	206	12
3,642	205	14
4,169	204	16
4,697	203	18
5,225	202	20
5,674	201	22
6,304	200	24

*Based on 29 inch barometer, with temperature at 70° F. at sea level.

AUTOMATIC CONTROLLERS

It is obvious that the control of time and temperature in processing is exceedingly important, so much so that most progressive canners have installed temperature controllers and timing devices, as well as recording thermometers, as part of the equipment, in order to guard against mistakes by the processor. These have been perfected to such a degree that in processing a retort the processor, or bathman, can turn on the steam, turn the key on the controllers, and know that the temperature will be maintained, that the steam will be cut off at the right time, and that the air and water will be admitted to properly cool the cans.

COOLING

As soon as the processing is completed the cans should be cooled with water. Unless this is done the heat will be held so long that the contents become overcooked. The cooling may be done by turning cold water into the retort, by removing the basket or crate of cans to a cooling tank, or by spraying with water in the air. There is less difference in the results obtained by different methods of applying either heat or cold than some claim; the important point is to accomplish these steps quickly.

WASHING THE CANS

While apparently a simple matter, the washing of cans is really a very important part of the process. From the moment the sheet has been coated with tin it begins accumulating foreign substances with most discouraging regularity. It does not follow that, simply because the can appears bright, it is strictly clean, as may be demonstrated by examining the water after rinsing a hundred or more. A large percentage of the packers are now using can-washing devices, but they should all use them. In most fish canneries the cans are washed before being filled, and then the outside is washed twice before the can reaches the retort, and once after coming out of the retort.

The devices used in washing are many and the packer has a wide range to select from. Some are patented devices while others are home-made affairs.

STAMPING CANS

Every can should be stamped or an identifying mark placed on it as soon as topped, or earlier, in order to avoid mixing in the warehouse. There are a number of little machines now on the market by which each can may be indelibly marked with any legend desired. The name of the goods, the quality and date, if desired (the code being secret, of course) may be placed on each can. When so marked the canner is sure of what is in the can, and is thus able to guard against imposition through the rejection of other goods as his, and in any action by the pure food authorities is enabled to identify his goods. A typical instance which came under the writer's observation exemplifies the value of this marking. A salmon canner had some 40,000 cases of salmon of about five grades, each piled by itself, in a warehouse, waiting for an opportunity to ship, when the piling underneath the floor gave way and all were precipitated into the water in one mass. As none of the cans had been marked the packer, after salvaging about two-thirds of them, had to sell most of them as of the lowest grade, thus losing the difference between the selling prices of the lowest and the higher grades, a very large sum in this instance.

INSPECTION

At all stages the packer should be on the lookout for unsound cans, or what are known to the trade as "swells." Before the cans are put on the market each one should be thoroughly examined and tested to detect any which have developed as "swells." The best time for doing this is after they have cooled on the cannery floor and are still in the coolers or crates, and thus easily accessible. The tester, armed with a thin piece of iron about 6 inches long, or a 12-penny nail, should pass over the cans and tap each one with the nail. Sound cans should show a vacuum, as indicated by the concavity of the ends, and should emit a peculiar note when struck. On the other hand, unsound cans which have not yet swelled give a characteristic dull tone when struck. By the difference in the quality of the tones a skilled inspector can instantly distinguish between sound and unsound cans. Any cans not showing a vacuum should be rejected. After inspection the cans are generally put in stacks, and before shipping are again examined.

SPOILAGE

Insufficient processing, defective containers or the use of unfit material may cause spoilage. These losses are generally classed under the heads of swells, flat sours and leaks. Some few years ago losses were heavy at many factories, but owing to a better knowledge of what is necessary in material, handling and improved appliances, these have been growing less each year. Formerly the processor used his own judgment exclusively, but now the up-to-date canner has accurate thermometers and gauges, automatic temperature-regulating devices, and time recorders, so that now the processor has merely to keep these multifarious agencies in working order and they will do the work. More attention is also now paid to the bacteriological side of the business, with the result that the product is handled in such a way that the bacteria are killed in processing.

Spoilage due to insufficient processing is generally divided into two classes—swells and flat sours. In the former there is a generation of gas, causing the ends of the cans to become distended; in the latter the contents of the can is sour, but there is nothing in the appearance of the can to enable the customer to determine the condition until the can is opened. Swells are generally due to under-processing good material, while flat sours most often result from giving the regular process to material which has been allowed to stand for some time. Swelling is more likely to occur and be detected early, while souring is apt to be delayed, though it may occur early. In the latter case the material is more or less sour to the smell and taste, but is sterile, the heat of processing having killed the bacteria.

There are two conditions known to the trade as "springers" and "flippers." The former is a can the end of which will bulge slightly after a time, but on opening there is found neither gas nor spoilage, though the cans have the appearance of being swells. It has been found that this condition is due to overfilling or to packing cold. When placed in a warm place, such as a well-heated grocery store, the can will bulge, owing to the temperature. A flipper is a springer of such mild character that the head may be drawn in by striking the can on a hard object, as a wooden block. The use of a microscope will quickly show the difference between a swell and a springer, as in the former there will be large numbers of organisms while in the latter there will be very few.

In these modern days can-making has reached such a point of perfection that manufacturers guarantee all above two to the thousand, and these imperfect cans are usually due to the solder not making a perfect union or to defects in crimping or double seaming. With the use of the automatic capping and tipping machines there are fewer leaks

than formerly occurred when the work was done by hand; leaks in sanitary cans are generally due to poor adjustment of the rollers. In the can-making plants leakers are recognized, as a rule, by testing in the hot bath. Leaks may be very small, even microscopic in size, and, therefore, difficult to detect, or pieces of the can content may be driven into the opening and seal it for the time. Leaks invariably cause swells.

TESTING ROOM

While the chief problem of the processor is to know when his goods are sterile, it is of equal importance for him to accomplish complete sterilization in the shortest possible time. This not only saves time and fuel, but also improves the appearance of the finished goods. In order to do this the canner ought to have means right at the factory of incubating samples of every lot of canned foods as they come from the retorts. A room having a constant temperature of approximately 98° F. may easily be built and maintained, and such a room will pay for itself in a very short time, and by means of it without further examination a packer can separate all swells and accurately determine whenever his process is insufficient in such a manner that swells are going to result. The "hot room" will even show, by the sense of taste alone in the canned foods stored therein for the proper time to allow of the development of bacteria, whether spoilage is going to occur or not.

Were the packer to supply himself with a good microscope, with one-twelfth oil immersion objective, and an incubator, it would be a very easy matter to know positively if a given process was sufficient. Several cans from each day's work could be placed in the incubator, and if the sterilization was not complete the bacteria would develop at a blood temperature (98° F.) within 24 to 48 hours; juice from these cans could be made into a hanging drop, and if any bacteria happened to be present, the microscope would reveal them. Most of the spore-bearing bacteria are motile, and there would be some present, even in small quantities of the juice, long before the formation of sufficient gas to swell the cans. By testing in this way the packer could also keep close watch on the sterilizing process, and in some cases could reduce the time, which would insure a better flavor at less expense.

"DO-OVERS"

For many years it was the custom, and is yet in some lines and plants, to take the defective cans found in inspecting the pack during the various stages after processing, and reprocess them by venting, repairing the can, exhaust, tip and process the regular time. As our knowledge of bacteria increased it was seen by the more intelligent packers that there was serious danger of ptomaines forming in the food in these leaky cans while the air had access to them, and also that the second cooking had a decidedly injurious effect upon the flavor and appearance of the food. As a result a number of the packers now discard entirely defective cans found after several days have elapsed after processing.

Those defective cans found while they are passing through the various processes, and while the cans are still warm, are repaired and placed in a lower grade.

SALT AND BRINE

Salt which is intended for use by canners should be as pure as possible. This fact is beginning to be thoroughly understood by the canner, who finds little economy in using an impure cheap salt, and, besides, may encounter certain difficulties if he uses

such. If salt contains an excess of magnesium sulphate or of lime, the latter in the form of calcium sulphate, it is liable, in the case of the latter, to produce a bitterness in the canned foods. Practically all commercial salt does contain a small quantity of lime, and it would be entirely impracticable to free the salt from the last trace of lime, on account of the enormous expense involved, but where the amount of calcium sulphate in a salt runs from 2% to 4% it shows that the salt has not been properly purified, and consequently it is not fit for use in delicate food products.

Impure salt contains a higher moisture content than pure salt, so that when the packer buys the former with an idea of economy he is likely to lose two ways: first, by getting too much lime, and, secondly, by getting too much water—both of which he pays for at the price of salt.

Some fishery products are covered with a weak brine when canned, and this brine generally contains about 2% of salt. Much care should be used in seeing to it that both the salt and water used in making the brine are suitable. The water used for making brine should always be free from iron, and from excessive suspended matter, and should be comparatively soft. A total hardness of 150 parts per million is about the limit permissible for canners' use. Most of the impurities which are likely to be present in a water of the hardness mentioned are harmless to canned foods, but if the water contains much iron there is danger of discoloring the flesh of fish processed in cans. This is the reason for the parchment paper lining, to keep the fish away from the can, because a very small trace of iron in fish will cause discoloration through the formation of iron sulphide from the sulphur which is liberated from the proteids of the fish by the high process.

The impurities which deleteriously affect the quality of canned foods are the same found in both hard water and commercial salt. It is, therefore, plain that both must be watched, because if both of them are very impure the sum of the impurities may readily become too great for canned foods.

When the hardness of water is excessive, and no soft water is available, the packer may often remove the hardness by a simple treatment of the water with soda ash. The latter precipitates the calcium and magnesium carbonates, which settle to the bottom as a white sludge, leaving the water in the upper portion of the tank comparatively soft and usually entirely suitable for canners. Water-softening in some such manner as above is practised by some canners through necessity, not only for obtaining a pure water for brine, but for obtaining a soft water for use in their boilers. A distilling apparatus especially designed for this purpose may also be used in obtaining the small amount needed for making brine.

Every canner should submit to a reputable chemist a sample of the salt he intends using in his season's pack, absolutely rejecting any brand that falls below 98% pure salt, and it would make assurance doubly sure to get a salt which tests not less than 99%.

MAKING BRINES

Various receptacles are employed in making brines. The favorite is a wooden tank in which is carried a copper pipe with an L on end to the bottom of the tank, and direct to the opposite side. In making the brine the water should be first brought to a violent boil, then add the salt, etc., and stir until dissolved. The steam jet used in this method obviates the necessity for much stirring of the mixture. The bottom outlet of the tank should be guarded with a strainer to retain chips and particles of other foreign substances which may be in the salt. If the material used contains much dirt or specks it should be placed in a closely woven bag and suspended just below the surface of the boiling water.

Brines of various strengths are used in canning some fishery products. The table following shows the proportions of salt and water required to make brines of given percentage strengths:

Strength of Brine. Per cent.	Salt Necessary. Pounds.	Water Necessary. Gals.	Qts.	Pts.
1	1	12	1	1
2	2	12	1	..
3	3	12	..	1
6	6	11	3	..
8	8	11	2	..
10	10	11	1	..
12	12	11	..	..
15	15	10	2	1
18	18	10	1	.
24	24	9	2	..

SOLDER

Solder is composed of lead and tin combined in various proportions—half and half for hard solder, 9 parts tin and 10 parts lead for medium, and 8 parts tin to 10 parts lead for soft. Many canners prepare their own solder, usually in bars. The finished article may be purchased in the form of triangular or rectangular bars, triangular drops, wire or wire segments. In the form of wire, wound on spool, it is used for power capping machines and is a convenient shape to use in tipping.

FLUX

It is so easy to purchase fluxes and soldering fluids, and the purchased articles give generally so much better satisfaction than those of home manufacture, that the canner will probably find it cheaper and better to buy the prepared article than to try to make one of his own.

TINNING THE CAPPING STEEL

The capping steel should be first cleaned with a file, brick or knife. Then take a section of a 3-pound tin can or an iron jar of about the same diameter and about 3 inches deep. Put into this about 2 inches of granulated sal-ammoniac and some scrap solder. Then clean the steels in diluted muriatic acid or in soldering flux and insert in the sal-ammoniac and solder, revolving it in the mixture until tinned. Then clean again in diluted muriatic acid or soldering flux.

TINNING THE TIPPING COPPER

The tipping copper is tinned in much the same way as the capping iron. Sometimes it is desirable, however, to file the tipping copper sufficiently to make it smooth and to correct the point. The copper should be filed to nearly a sharp point. All particles of smudge, burned materials, etc., should be removed from the iron before tinning. Heat the copper and rotate the tip of it in the mixture of sal-ammoniac and solder until it has been covered with the melted solder and is as bright as silver.

LACQUERING

Formerly it was the custom to lacquer nearly all cans containing fishery products. This custom originated in the early days of salmon canning and was due to the following reasons: The English market, which at that time absorbed the greater part of the goods, insisted on their shipments being finished in this way; and the canners thought that if they did not protect their cans in some way enormous losses through rust, caused supposedly by the long sea voyage, would ensue. Several machines are in use for doing this work and perform it excellently. Several of the largest salmon packers, however, now use enameled ends and depend upon the label to protect the sides, for both domestic and foreign shipments, while a few flat and oval cans are not lacquered at all, but are protected from rust by wrapping in tissue paper, over which the label is placed.

It is the custom with sardine canners to print a number of copies of the label on a sheet of tin, and then lacquer it, after which the cans are cut out, shaped and the ends put on. Some packers, however, do not lacquer the cans at all and protect them either by putting in a printed carton or wrapping in tissue paper and pasting the label over this.

Many fishery products are wholly packed in unlacquered cans, and this custom is steadily growing in favor, especially for goods sold in the country of origin.

The quick-drying brown lacquer used quite generally at the present time carries asphaltum in the form of an asphalt varnish as its base, this being supplanted in some cases by gilsonite. This lacquer can be procured in either a heavy or light body, is generally reduced with benzine or gasoline, and is applied according to the requirements of the market, which in some localities demands a heavy coating and in others a much lighter finish, the latter giving a rich golden brown color. Some experiments have also been made in using brighter colored lacquers for this work. Several of these, made to give a bright golden copper, or other color, are extremely attractive in appearance, while at the same time protecting the tin against rust quite as well as the brown.

The lacquering period is one of considerable danger in canneries, especially in damp or rainy weather, when it is not possible to open warehouse doors and windows, the gas arising from the vats being highly inflammable. The striking of a match by a careless workman under these conditions is apt to cause an explosion, with a resulting fire which may occasion either partial or total loss of the plant, and also cause injury or death to some of the workers.

LABELS

A very important feature of the canning industry is the selection of appropriate brands or labels for the various kinds of fishery products. A well-known brand has a value in itself and sometimes is a very important asset. A packer will sometimes market a considerable part of his product in one section, and here, where the consumer has become familiar with the label and pleased with the contents of the can, he will ask for and accept no other, despite the fact that the latter might be, and probably is, the equal of the product he has been using. Elsewhere in this work will be found a copy of the Trade Mark law of the United States and other information relating to the protection of trade marks not only in the United States but in foreign countries as well.

In designing a label there are several things which should be borne in mind. It should be an easily remembered name and design; a name difficult of pronunciation should be avoided at all cost. The design should be as simple as possible, as experience has demonstrated that a simple form—so simple that it can be fully understood by a mere glance—will gain by regular repetition, while a more complicated design will lose in this process.

A special room should be provided in the cannery for labels, and this should be, as far as possible, dust and steam-proof. Each size and variety of label should have a compartment by itself. It is best to wrap each bundle of labels in paper, with one placed on top outside.

The cans should be labeled with the cap end down. Expensive labels, such as gilt and embossed, should be protected with an outside wrapper of tissue paper. There are on the market several makes of machines suitable for putting the labels on the cans.

CARE OF CANNED GOODS

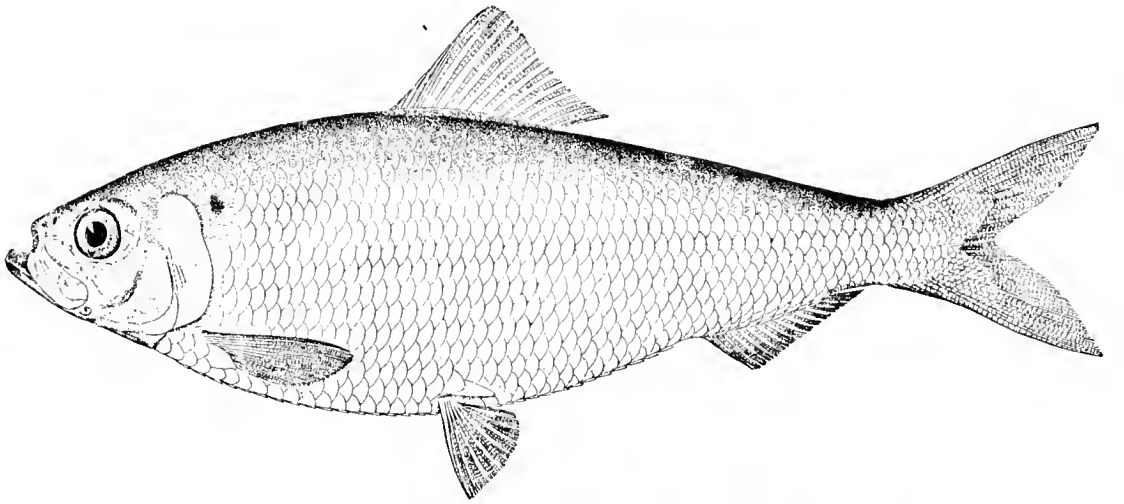
Much waste of food in wholesale and retail stores results from carelessness in providing dry storage space for canned goods. Moisture will rust tin goods, producing holes in the cans and resulting in spoilage. Even in the cases where cans are not perforated and the contents spoiled, they will be discolored and the labels rusted when stored in places which are liable to become either too warm or too moist. The bright, attractive appearance of canned goods is an important factor in their sale, and all labor and care given this merchandise is repaid many fold in the maintenance of attractiveness which makes for sales. It should be the duty of everyone, from the manager down, to see that canned goods are given safe storage.

FROZEN CANS

Frozen canned goods should be stored in a dry, cool place until they thaw out. Freezing sometimes causes them to puff out like swells, from the expansion of the contents from freezing. The puffing will subside in a few days after the goods are put in a warehouse, and the quality of the goods is seldom injured by freezing. If stored in a warm place such goods will "sweat" and rust.

FISHES

ALEWIVES



ALEWIFE, OR BRANCH HERRING *(Pomolobus pseudoharengus).*

THE alewife or branch herring *(Pomolobus pseudoharengus)* and the glut herring *(P. aestivalis)* are marketed under the name of alewife or river herring. The two species are found, either singly or together, in waters adjacent to the Atlantic Ocean from Florida northward to Labrador. The former is also found in certain small lakes in New York tributary to the St. Lawrence River and in Lake Ontario. Like the shad, they are anadromus species, living normally in salt water and only entering fresh water streams for the purpose of spawning. They are generally caught at the same time with, and in the same apparatus as, the shad. *P. pseudoharengus* appears in the rivers three or four weeks earlier than the glut herring and the shad. Both species average about a half pound in weight and from 8 to 10 inches in length.

The alewife fishery is one of the most important carried on by our fishermen. In 1908, the last year for which we have complete data, the fishermen marketed 89,978,000 pounds, valued at $589,000. Alewives were taken in every state on the Atlantic seaboard, but three states—Virginia, Maryland and North Carolina—produced over 80 per cent. of the total. In Canada during the year 1916-17 there were marketed by the Canadian fishermen 5,874,000 pounds of alewives.

Pound nets, trap nets, weirs, seines and gill nets were the principal apparatus used; the fixed gear caught over 73 per cent. of the total.

The hickory shad *(P. mediocris)*, which is also known as fall herring, is fairly common from Cape Cod to Alabama. It is most abundant in the vicinity of Chesapeake Bay. In the southern portion of its range it enters the streams, in Chesapeake Bay usually appearing in the rivers in the spring, before the shad. It reaches a maximum length of 24 inches, though examples of more than 3 pounds weight are not often seen. They are frequently sold to the unwary as shad. It does not rank high as a food fish. In 1908 876,000 pounds, valued at $38,000, were marketed by our fishermen. The bulk of the catch comes from North Carolina, Virginia, Florida and Alabama.

The opportunities for the building up of an important canning industry based upon alewives are exceptionally good. The raw material is abundant and cheap, while

by the use of pound nets and weirs the fish can be held alive in the apparatus for a day or two in times of glut, an important advantage. The region in which the alewife is most abundant—Virginia, Maryland and North Carolina waters—is the habitat or resort of several other abundant species, noted elsewhere in this work, which can also be canned with profit.

As soon as landed the fish are scaled, eviscerated, the fins cut off and the heads removed, after which they are washed in clean water. On Chesapeake Bay the fish are then placed in the salting vats, the bottoms of which are first covered with 4 or 5 inches of very strong brine. As the fish are put in they are stirred about, after which more salt is put on top, and so on fish and salt alternately, until the total quantity of fish is in the vats or the latter are full; 6 barrels of salt are generally used for 32 barrels of fish. After 12 to 14 hours the mass is broken up with a spudger, after which they are removed and washed in an abundance of lukewarm fresh water, thoroughly drained, and packed in the cans. The cans are then exhausted for about 10 to 15 minutes at 212° F., after which they are processed at 244° F., No. 1 cans for 55 minutes, No. 2 cans for 60 minutes. The fish shrink considerably in processing; this may be overcome largely by first drying the fish for a while in an artificial dryer, which will remove part of the moisture.

They can also be kippered the same as recommended for sea herring and then canned, using the same process as for the latter.

The fish can also be packed in tomato or mustard sauce, either of which would improve its flavor. By following closely the methods used by the packers of sea herring alewife canners will be most successful in producing a choice canned article.

ANCHOVIES

On the Pacific coast from southern Alaska to Lower California is found the Northern anchovy (*Engraulis mordax*). South of Santa Barbara are also found two other anchovies, the Southern anchovy (*Anchovialla delicatissimus*) and the deep-bodied anchovy or sprat (*A. compressus*).

The Northern anchovy is the largest and most valuable of our anchovies, growing to a length of 7 inches. It is found in great abundance and is canned to some extent in California. It is, at present, considered inferior, when canned, to the sardine, but this, it is believed, is mainly because the proper methods of canning are not practised.

The Southern anchovy is very abundant on the southern California coast. It does not much exceed 3 inches in length. It is most delicate when crisply fried in oil.

The deep-bodied anchovy grows to a length of 5 inches and is abundant on the southern California coast. Its flesh is thin and dry and cannot be compared with the other two anchovies.

In canning the same methods are followed as in canning sardines in southern California, but under a ruling of the federal government the name "sardines" must not be applied to them.

In Sweden a considerable industry has been created in the canning of anchovies, which are, however, really sprats, the real anchovy occurring but rarely in Swedish waters. They are also prepared in Finland and Germany, and in the latter country are known as "delikatessen." Each manufacturer has his own special recipe, which is kept secret.

A consular representative furnishes the following account of the process:

"The preparation of sprats and small Baltic herring *(strömming)* as delikatesser has been carried on in Finland for many generations as a household industry, the fishermen

of some districts having a great reputation for the excellent wares produced. There are now several preserving factories for making anchovies and spiced herring at Helsingfors and at Reval, on the Russian coast, and practically all the sprats taken—often over 2,000 cwt.—are made into 'anchovies.' Thanks to the fact that a fishery expert carried on experiments on the processes for three years and has published the details in a Finnish technical journal, we are enabled to give below exact recipes for the preparation of the anchovies or spiced herrings, the recipes for each being the same. The sprats are first thoroughly washed but are used whole and ungutted, and, following the Finnish practice, the small herrings are treated in the same way. Only the very best and fattest herrings are used; spawning or meagre fish are rigorously rejected. The most suitable are the small fat *stromming* caught in autumn by drift nets, and they must be perfectly fresh. In Sweden the small herrings are gutted, beheaded and cleansed, but it is objected that by gutting and cleaning the valuable rich intra-abdominal fat is removed, and the native practice of using the herring whole is recommended. The process is usually carried on in the small keg known as a sprat keg (*hrassbukskaggar*), but tins are recommended instead for domestic or local use, usually of one litre capacity, while goods for export must be put up in air-tight tins in the usual way.

"The preservative and spicing mixture consists of (1) ingredients for the preservation of the fish, and these consist first of all of common salt, and secondly of sugar. The proportion of salt varies according to the season, the degree of durability required, etc.; (2) ingredients for flavoring consisting of saltpetre, Jamaica pepper, black pepper, white pepper, Cayenne pepper, cloves, mace, ginger, cinnamon, red sandalwood (for coloring), Spanish hops and bay-leaves. No recipe includes all these substances, and the proportions vary considerably in different recipes. As for salt, finely crushed Luneburg salt is said to be the best, though a recent Finnish recipe (No. VIII.) provides for Liverpool salt ('pure dried vacuum salt'). The saltpetre and the sugar should be finely powdered; the different varieties of pepper should not be too fine, but not coarse; the cloves, mace, cinnamon, sandalwood, and ginger should not be too finely powdered, while the Spanish hops and bay-leaves are used whole, the hops being mixed with the other spices while the bay-leaves are used whole and placed between the layers of fish. It is said the weighings must be accurate. The salt, sugar and saltpetre are first weighed out and thoroughly mixed together; then the other ingredients are weighed and thoroughly mixed with the salt and sugar.

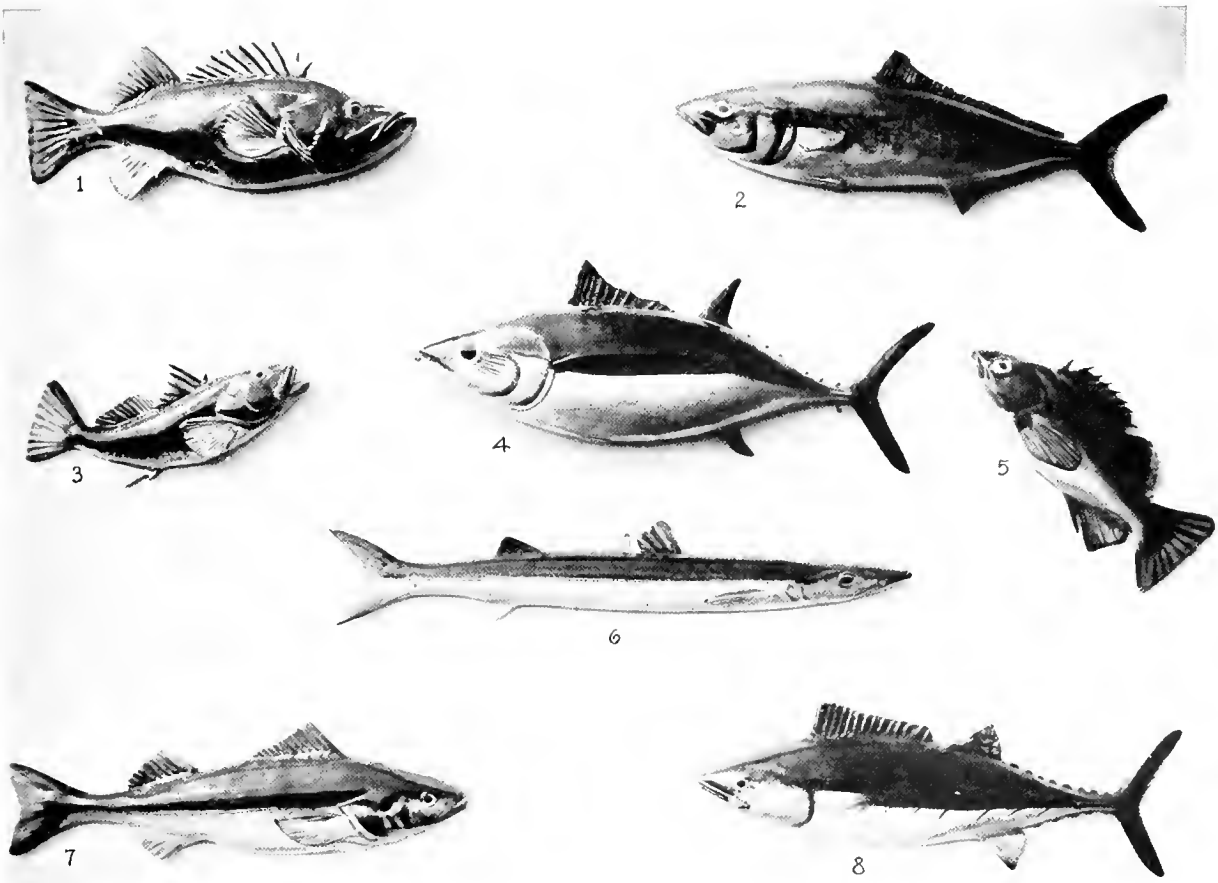
"In dealing with sprats the fish are well 'roused' with the mixture. A preliminary 'rousing' is not mentioned in connection with the herrings, the process being as follows: Some of the spice mixture is strewn on the bottom of the one-litre tin, then a layer of herrings, in rows, is placed upon it, with the backs of the fish downwards and the mixture strewn over it; another layer of herrings is laid down in the same way, the rows being placed obliquely across the rows in the layer below, and so on, not more than four layers being laid down in the one-litre tin. One whole bay-leaf is placed at the bottom, one between each layer, and one on the top. The lid is then put on, and for local use made airtight with paraffin wax. The tins, after being closed, are placed in a cool place, preferably in an ice-house; it is said there is no comparison between the product left to ripen in a warm room and that ripened in a cool place. No temperature is given, and probably the best course for any one trying the process is to follow the practice in Germany, keeping the temperature at about 39° F.

"With regard to the recipes given and reproduced here, it is said that No. VI. is a Danish recipe and No. VII. an old Norwegian recipe for spiced herrings (*kryddersaltet-sild*), a little modified, and furnishing, it is said, a very fine product. The others are the

result of the Finnish experiments; No. VIII. is the most recent, and is described as in very general use. In the table the original weights for a one-litre tin are given in the

	Grammes per litre	Ounces per 10 gallons	Grammes per litre	Ounces per 10 gallons
	No. I.		No. II.	
Luneburg salt	125-150	198 4-238 1	150	238.1
Sugar	50	79 4	100	153.8
Saltpetre	1½	2 38	2	3.2
Jamaica pepper	3½	5 5	—	—
Black pepper	1	1 6	2	3 2
Cloves	1½	2.38	1½	2 38
Mace	1	1.6	—	—
Cinnamon	½	0.8	—	—
Ginger	½	0.8	1	1.6
Sandalwood	—	—	1	1 6
Spanish hops	—	—	1	1 6
Bay leaves	1½	2.38	2	3 2
	No. III.		No. IV.	
Luneburg salt	125-150	198 4-238 1	100	158.8
Sugar	60	95 2	50	79 4
Saltpetre	1	1 6	1	1.6
Jamaica pepper	2	3.2	3	4 76
Black pepper	—	—	2	3 2
Cloves	1	1 6	1½	2 38
Ginger	1	1 6	1	1.6
Sandalwood	1	1 6	—	—
Spanish hops	—	—	1	1 6
Bay leaves	½	0 8	2	3 2
	No. V.		No. VI.	
Luneburg salt	125	198.4	125-150	198 4-238 1
Sugar	50	79 4	60	95.2
Saltpetre	1½	2 38	—	—
Jamaica pepper	6	9 5	—	—
Black pepper	3	4 76	—	—
White pepper	—	—	2	3.2
Cloves	1½	2 38	½	0 8
Mace	—	—	½	0 8
Ginger	2	3.2	½	0.8
Cinnamon	—	—	1	1.6
Spanish hops	1	1 6	1½	2.38
Bay leaves	1	1 6	1½	2.38
	No. VII.		No VIII.	
Luneburg salt	150	238.1	—	—
Liverpool salt	—	—	150	238.1
Sugar	80	127 0	100	158.8
Saltpetre	1	1 6	—	—
Jamaica pepper	2	3.2	4	6.4
Black pepper	1½	2 38	3	4 76
Cayenne pepper	—	—	0 04	0.06
Cloves	1½	2 38	2	3.2
Sandalwood	1½	2 38	1	1.6
Cinnamon	1½	2 38	1	1 6
Ginger	1	1.6	2	3.2
Mace	—	—	1	1 6
Spanish hops	1½	2.38	2	3 2
Bay leaves	2½	4.0	2	3 2

first column, and this has been calculated, for ten gallons, in English ounces in the second column; one litre is equal to 0.2201 imperial gallon, and, approximately, 4½ litres are equal to one gallon; one ounce is equal to 28.35 grammes. It will be noticed that the composition of the mixture, and especially the proportion of the various spices, varies considerably; apart from the salt and sugar the weight of the spices for a one-litre tin ranges from 6½ grammes (No. III.) to 18 grammes (No. VIII.). It would almost seem as if every manufacturer had his own recipe. There is at all events in the above table sufficient information for trials to be made in the preparation of this delikatessen in this country, and it is to be hoped such trials will be carried out."



LEADING COMMERCIAL FISHES OF SOUTHERN CALIFORNIA.

These Pictures Were Made from Models Owned by Warren S. King, President of the White Star Canning Co., and are as follows: 1—Grouper or Rock Cod; 2—Yellowtail; 3—Rock Bass; 4—Albacore or Tuna; 5—Wall-Eyed Bass; 6—Barracuda; 7—Black Cod, and 8—Bonito.

BARRACUDA

The barracuda (*Sphyraena argentea*) occurs on our Pacific coast from San Francisco to Cape San Lucas, being very common among the Santa Barbara islands. Many are taken commercially by the fishermen of southern California. It is a long, slender fish and reaches a length of 4 or 5 feet. It rarely exceeds 15 pounds in weight, and usually appears in early spring in vast schools coming from the south. In 1917 the fishermen of

California caught 3,080,810 pounds of barracuda. As the catch at present is larger than can be marketed fresh, experiments have been made looking toward the smoking and canning of the surplus, and Dr. E. D. Clark, and H. D. Davi, of the U. S. Bureau of Chemistry, have published the results of such in a preliminary announcement issued by the Bureau, from which I have condensed the following data:

The authors recommend that the barracuda be dressed as soon as caught as otherwise the fish will rapidly deteriorate. In this operation the gills and entrails are removed and the blood carefully scraped out of the body cavity and around the backbone. The fish should be thoroughly washed in a weak brine testing about 10 per cent. saturated salt solution.

On reaching shore the head and tail are first removed and then the fish scaled thoroughly. The cut along the abdominal cavity made in dressing is continued with a long, deep incision down the ventral surface to the tail, in order to release any blood lodged along the tail bone, after which the fish is thoroughly washed, a moderately stiff brush being employed for doing this work. The fish is then given a final washing in a weak brine testing about 10 per cent. salt, or in clean sea water, after which they are allowed to drain.

The fish should be graded now into three sizes, measuring 17, 21 and 25 inches, respectively, from the napes to the end of the tail. In order to allow quicker penetration of the salt in the pickling process several cuts should be made through the skin on both sides of the fish; these cuts should be made into the thick portions of the oily dark flesh on the lateral line.

In splitting the fish the knife is inserted and pushed along the left side of the backbone and the cut continued to the tail, the sides being thus laid flat. The knife is then inserted under the backbone and the above operation repeated, when the latter can be removed. Care should be taken that the knife does not penetrate beyond the inner side of the backbone as otherwise the back of the fish will be weakened. In this condition the fish will lay flat.

No fresh water should be used in washing the fish after splitting as it tends to "puff" the flesh, encouraging rapid decomposition. Puffing also results in the loosening of the flakes of flesh from the skin, which greatly mars its appearance when finished.

The fish are then buried in a cold brine testing about 75 per cent. saturated salt solution. Care should be taken that all parts of the fish are submerged below the surface of the brine. If the fish are intended for immediate consumption (within 2 to 4 days), three-quarters to one and one-quarter hours of brining will suffice. For canning purposes one-half to one hour of pickling will give the desired saltiness. Longer brining does not increase the keeping quality, but rather tends to injure the palatability of the final product.

The fish are then drained and dried, first by waterhorsing in small piles, flesh side down, and then by drying on trays, with wire bottoms, placed on racks in the sun. The appearance of the fish will indicate when the drying process has progressed sufficiently. Should the weather be unfavorable the drying may be carried on in the smokehouse, after opening doors and ventilators to allow a free circulation of air and by keeping fires burning slowly until the completion of the drying, but the temperature should not exceed 100° F. in the smokehouse.

After drying, the fish are removed from the trays and suspended from the napes with two "S" shaped hooks, and hung on iron rods about ½-inch in diameter.

Smokehouses may be of any design, size and number of compartments, the only essential being that they be constructed in such a way that various kippering tempera

tures, ranging from 80° to 125° F. can be easily and continuously maintained. Experiments show that the temperature for kippering barracuda should be kept as near 105° as possible, and under no circumstances should it exceed 115° F. The house should be of moderate height with some system of ventilation on the top and upper sides. Supports on which to hang the smoke rods should be placed in the smokehouse, beginning about 7 feet above the fire and continuing for 7 or 8 feet.

The rods filled with fish are now placed in the bays or upper part of the smoke house, the largest fish being hung uppermost. Several small fires are then built in shallow depressions in the earth floor, dry hardwood blocks such as oak, maple, alder or of tan bark being employed. No resinous material should be used. When the fires have begun to burn vigorously, the flames are smothered with a small amount of dry hardwood sawdust in order to maintain the temperature at the desired point. Several Fahrenheit thermometers should be placed among the fish and the temperature kept from 100° to 105° F. Should the temperature begin to rise, the upper ventilators are opened to release the hot air. If the fish are intended for canning, a smoking of 7 to 8 hours or less at 100° F. is sufficient to give the flavor, color and texture desired. The color of the product can be controlled by the density of the smoke.

After kippering is completed all doors and ventilators should be opened to allow the fish to cool thoroughly. After cooling the fish are removed from the smoke house and the sides carefully wiped free from particles of soot and dust which may have collected during smoking. Evaporation of the salt near the tail end, and shrinkage of the skin away from the outer edges of the flesh are evidences of too high temperatures during smoking.

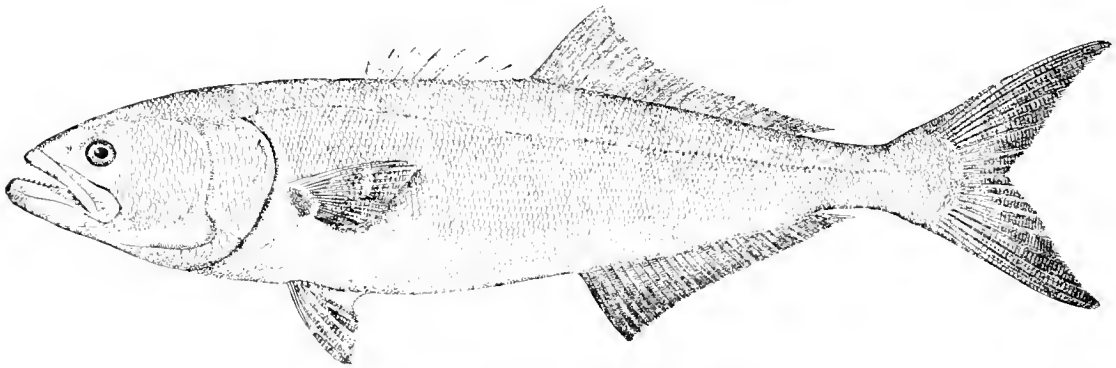
In canning the sides of the fish are cut into choice square pieces to fit the size cans to be used. The skins are removed and the pieces placed in the can with the brown side up. The cans are then filled with peach kernel or any pure nut oil, as these seem to blend well with the smoke flavor and the natural oil of the barracuda. If so desired, the fish may be packed in a light brine, but their appearance is somewhat altered by processing in such a brine. The cans should be exhausted 25 minutes at 212° F., sealed immediately, and then processed three hours at 212° F. A bath of boiling water should be used for the processing as a steam retort does not give a uniformly cooked product. After removal from the bath the cans should be cooled in a stream of cold water. The amount of water in the can after processing should not exceed 25 per cent. of total volume of the liquid if packed in oil.

For canning purposes the average loss in weight from the round fish to the fish when ready for packing is 50 per cent.

BLUEFISH

The bluefish (*Pomatomus saltatrix*) is found on our Atlantic and Gulf coasts. From Cape Florida to Penobscot Bay bluefish are abundant at all seasons when the temperature of the water is propitious, which probably is above 40°. The menhaden is their principal food and their abundance is largely dependent upon the presence of that species. The bluefish is a pelagic or wandering fish, very capricious in its movements, varying in numbers at particular localities in different years and sometimes disappearing from certain regions for many years at a time. It is a carnivorous animal of the most pronounced type and does a tremendous amount of wanton destruction amongst the menhaden schools. The average size of the bluefish is 3 to 5 pounds and the maximum size is about 15 pounds. It is one of the best of food fishes, ranking in public estimation next after the fresh mackerel. The flesh is firm and very sweet.

BLUEFISH



BLUEFISH *(Pomatomus saltatrix).*

In 1908 the bluefish catch amounted to 7,647,000 pounds, valued at $506,000, the smallest catch for years back. Lines take nearly half the catch. Gill nets, pound nets and seines also take considerable quantities. Nearly one-half of the catch was made by New York fishermen.

Small quantities of bluefish have been canned at times and made an excellent product. As soon as possible after being landed the fish are scaled, the head cut off, the belly slit down to the vent and the entrails and backbone removed. The fish is then cut into pieces of suitable size and placed in 50 degrees (salometer) brine and soaked until the blood is extracted. The fish are then put into cans which are filled up with brine made by dissolving 3 pounds of salt in each 12½ gallons of water used, the tops put on, exhausted 10 minutes at 212° F., vented and processed 80 to 100 minutes at 240° F. The cans are then removed from the retort and run through the cooling bath.

BONITO

The California bonito, or skipjack *(Sarda chilensis)* is found from San Francisco to Patagonia, also around Hawaii. It is abundant in summer in the northern part of its range. It reaches a length of 2 or 3 feet and a weight of 20 pounds. The average weight is said to be about 8 pounds. It is caught by trolling and can be kept around the boat by chumming. The species comes north in spring and leaves for the south in winter. While it is a near relative of the albicore, its flesh is a pale grey instead of being white like the former.

During the last few years the tuna canners of southern California have been canning bonito when not busy on the former, and are rapidly developing a market for the product. It is canned in almost identically the same way as tuna.

The Atlantic bonito *(Sarda sarda)* likes the open sea, wandering around in large schools in search of food, and only approaches land when attracted by abundance of suitable food or for spawning purposes. It occurs in summer from Cape Cod to Cape Sable, and occasionally in the Gulf of Mexico. It reaches a length of 2 or 3 feet and a weight of 10 to 12 pounds. Its flesh is fully as good as that of its Pacific brethren, and ought to make a good fish for canning. The bulk of the catch of this species is made in New Jersey, and is taken mainly in pound nets, although lines also bring in a considerable quantity. It is probable that the catch could be largely increased if vessels were sent farther off the coast in search of the fish.

CATFISH

One of the most important commercial fisheries of the North American continent is that for catfish. Most of these are obtained in the fresh waters, the principal ones being the channel cats (*Ictalurus*), mud cats (*Amciurus*), yellow cats (*Leptops*), and stone cats (*Noturus*). There is much confusion, however, in the application of these names, the name in common use in one place sometimes being applied in another place to a totally different species. There are also two species of salt water catfish, one of which has attained to considerable commercial importance. These are the gaff-topsail cat (*Felichthys marinus*) and the sea catfish (*Galeichthys milberti*).

The catfish is found in most fresh waters east of the Rocky Mountains, thriving best in the Mississippi Valley. None are indigenous to the Pacific coast, although *Amćiurus nebulosus* and *Amciurus catus* have been introduced into California waters, and have become fairly abundant.

The catfishes range in weight from a few ounces to 150 pounds, and in size from a few inches to 5 feet. They attain their greatest size in the Mississippi Valley. The flesh is firm, flaky and of excellent flavor.

The U. S. census returns for 1908 show that 18,386,900 pounds, valued at $792,830, were marketed. There has probably been a large increase in the production of these fishes since then. At that time Louisiana produced 4,405,000 pounds, but the claim is made that the production here is now about 18,000,000 pounds a year. Illinois and Florida are also heavy producers of catfish.

In Canada, in 1916-17, the catch amounted to 939,200 pounds, valued at $74,068. Ontario produced more than half of the total.

Catfish are taken with many forms of apparatus, although trot lines and fykes seem to be the favorites.

The catfish has been canned in Louisiana, but it was camouflaged as salmon, and the enactment of the Pure Food Law killed the business.

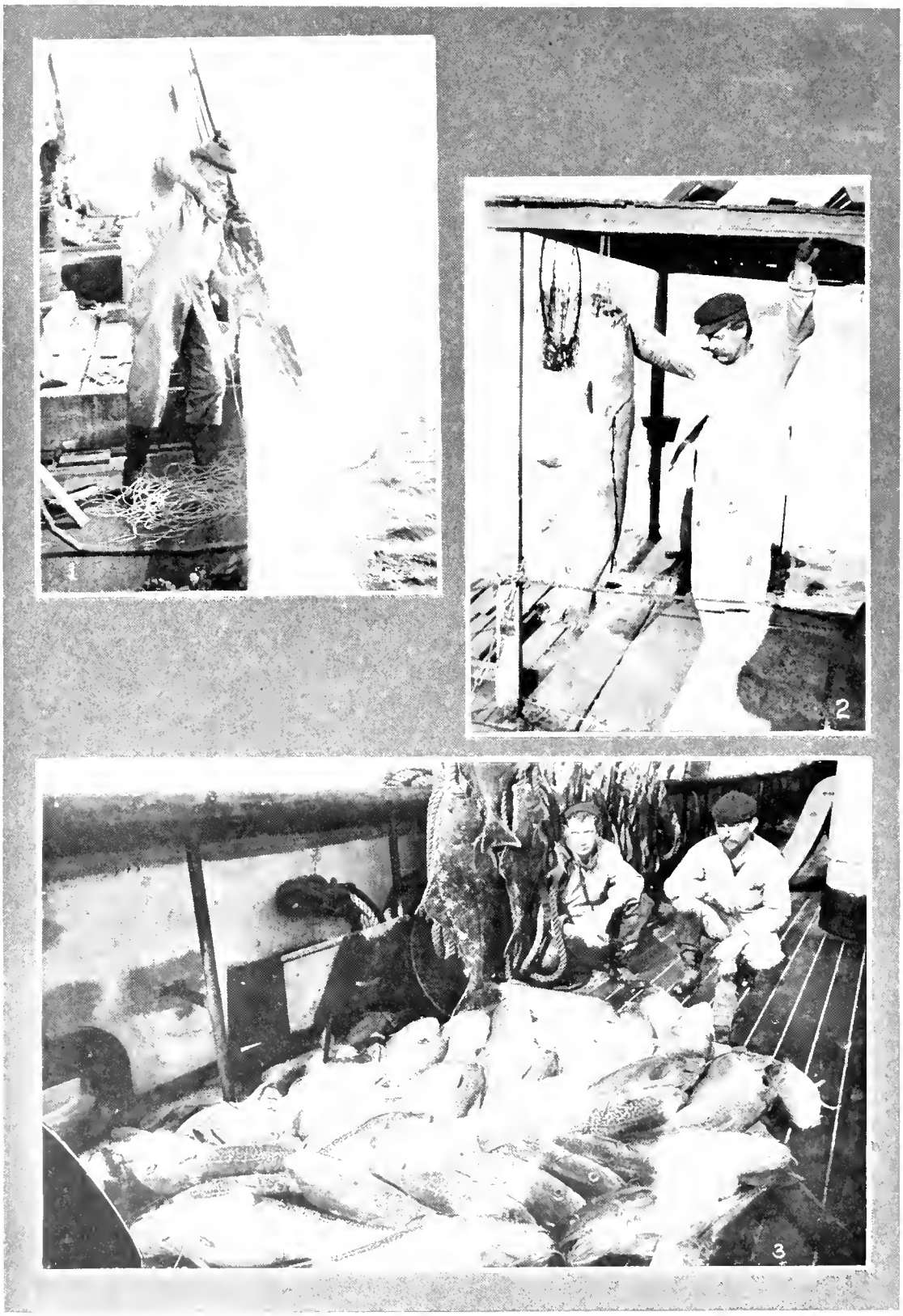
The following method is suggested as probably suitable for canning catfish, but care should be used at first to test the method at frequent intervals.

The fish should be skinned, dressed, the head removed and the body cut into lengths to fit the can. The pieces should then be put into a 60° (salometer) brine solution and allowed to soak until all the blood has been extracted. The brine should be made fresh every time. The pieces can then be put into the cans with $\frac{1}{4}$ ounce of salt added for a 1-pound can, the top put on loosely, and the cans exhausted for about 15 minutes at 212° F. The tops should then be sealed tightly and the cans processed for from 60 to 80 minutes at 240° F., after which the cans should be removed from the retort and cooled in the cooling bath or with a hose.

CODFISH

One of the best opportunities for the development of a large industry in the United States and Canada is to be found in the canning of "codfish flakes," or "fish flakes," as they are called when haddock or some other member of the Gadidæ is mixed with the cod. In this condition codfish is a much more sanitary and useful product than the dry-salted fish, and also has the advantage of being available for use every month of the year, and not, as in the case of the dry-salted product, unmarketable during the hot season.

The family Gadidæ is a large one with about 25 genera and 140 species, many of which are highly valued as food. They inhabit chiefly the northern seas; one species



CATFISH AND COD FISHERIES.

1. Catching Cod Over the Rail of the Vessel; 2. An Ohio River Catfish, and 3. Cod on the Deck of the Vessel; Several Halibut are also Hanging from Shrouds.

(Lota) is confined to freshwater lakes and streams. The cod fisheries of the world are surpassed in importance only by those for herring.

The common codfish (*Gadus callarias*) is found in the North Atlantic and on both coasts, south to France and Virginia. A very similar species is the Alaska codfish (*G macrocephalus*), which is very abundant in Bering Sea on both shores, and ranges southward on our coast as far as Cape Flattery. Both are exceedingly important factors in the fisheries of the United States and Canada, notably on the Atlantic coast, our Pacific fishery not having as yet been developed to such an extent. The other members of the family are usually taken at the same time as the cod.

Cod vary greatly in size and weight, some attaining a very large size. They are generally taken with hand and trawl lines, and can be caught any month in the year. In Alaska shore stations are maintained at various places in the Shumagin and Sannak groups, and on Unimak Island, most of these being operated all the year, while a fleet of vessels frequent the off-shore banks in the North Pacific and Bering Sea from May to August inclusive. On the Atlantic fishing is prosecuted on the banks adjacent to the New England coast and on the Grand Bank. A fishery with boats is also prosecuted off the New Jersey coast.

While the Atlantic waters produce several very important species closely related to the true cod, and which can be marketed along with them, our Pacific waters produce but one or two species, and these too small to be marketed along with cod.

The most important of the related species is the haddock (*Melanogrammus aeglefinus*), which occurs from Cape Hatteras north to the Strait of Belle Isle. They are abundant on the Massachusetts coast in summer, and it is then that the largest catches are made there as well as on the off-shore banks in the Gulf of St. Lawrence. The usual size of the haddock is about 3 or 4 pounds, and the maximum about 17 pounds.

The pollock (*Pollachius virens*) is common on both coasts of the Atlantic, on our side ranging north from New York. It is most abundant in the southern part of its range, and at times is quite common as far south as Cape Cod. It reaches a length of more than 3 feet and a weight of 25 pounds or more.

The Alaska pollock (*Theragra chalcogrammus*) is found in Bering Sea and neighboring waters south to Sitka and the Kurils. It is very abundant throughout Bering Sea, swimming near the surface and furnishing the greater part of the food of the fur seal. It reaches a length of 3 feet. No fishery has yet been established for it.

The codlings, or hakes, contain only two species which are of value as food. These are the white hake (*Urophycis tenuis*) and the squirrel hake (*U. chuss*). They are found on our Atlantic Coast from Labrador to Cape Hatteras, being especially abundant to the northward, and are found at a depth as great as 300 fathoms. They are most abundant during summer and fall along the coast of Maine and Massachusetts. The average size of the hake taken probably does not exceed 5 to 10 pounds, though each species reaches a much larger size. A quite extensive fishery is prosecuted for hake, lines and trawls being employed.

The cusk, or torsk (*Brosmius brosme*) is a large fish found on both shores of the North Atlantic, on this side ranging north from Cape Cod.

The common tomcod or frostfish (*Microgadus tomcod*) is a very small codfish which is found on our Atlantic coast from Virginia to Cape Sable. On the Pacific coast is found the California tomcod (*M. proximus*), which occurs from Monterey Bay to Unalaska. They are most abundant in early winter, when they approach the shores and even ascend rivers and creeks for spawning purposes. Though most abundant in winter they may be found along the shore at all seasons. The tomcod rarely exceeds a foot in length.

The only freshwater member of the cod family in North America is the ling or lawyer (*Lota maculosa*). It is found pretty well distributed in the larger lakes of Canada and the northern United States from Maine and New Brunswick to the headwaters of the Missouri, and to Alaska. It is probably most abundant in the Great Lakes. It reaches a length of 1 to 3 feet.

As soon as caught all of the Gadidæ, and, in fact, any of the large species, should be bled by having its throat cut. This gets rid of most of the blood and prevents it from discoloring the flesh if allowed to congeal in the fish after death.

During the calendar year 1917 the American fishing fleets operating from Gloucester and Boston, Mass., and Portland, Maine, landed the following catches of cod and related species: Cod, 56,446,528 pounds; haddock, 53,554,385 pounds; hake, 7,914,646 pounds; pollock, 14,507,792 pounds; cusk, 3,549,303 pounds; livers, 959,420 pounds; sounds, 53,335 pounds; tongues, 1,688 pounds, and spawn, 148,591 pounds. This does not take into account the large quantity of the various species landed at other ports in New England and the Middle Atlantic states, other than New York and New Jersey, for which we have no data available for the year in question. This catch would run up into the millions of pounds. In New York and New Jersey the fishermen landed the following: Cod, 436,075 pounds; haddock, 24,775 pounds; hake, 2,161,787 pounds, and pollock, 320,062 pounds. In 1908 the tomcod catch of the United States amounted to 289,000 pounds.

The catch in Pacific waters by the American fleet and shore stations amounted in 1917 to 15,522,532 pounds of cod.

During the year ended March 31, 1917, the fishermen of Canada landed the following catches of cod and related species: Cod, 196,286,000 pounds; haddock, 58,202,800 pounds; hake and cusk, 38,595,300 pounds; pollock, 14,330,600 pounds; tomcod, 1,431,400 pounds; tongues and sounds, 242,800 pounds.

Newfoundland and Labrador during the year 1917 produced about 1,299,200,000 pounds of the various species of the Gadidæ.

Codfish and the related species may be canned either plain or corned. In canning plain codfish the fish should be split to the vent, the gill rakers, entrails and membrane lining (in the majority of cases this will be black, and will not look good in the can) of the stomach removed, the head and fins cut off, and the fish cut in pieces to fit the size of the can to be filled. They are then put in a tub and covered with a brine of 50° (salometer) strength and soaked one or two hours in order to extract the blood, etc. The thicker the fish the longer the soaking required. After the fish have been removed this brine should be thrown away and a fresh brine made for the next lot. The fish should be put into the cans, the tops put on loosely, and the cans run through the exhaust box for 10 minutes at a temperature of 212° F., then be sealed up and processed 45 minutes at 240° F., then raise to 250° F. for 10 minutes; or processed 65 to 70 minutes at a temperature of 245 to 247 degrees. After removal from retort they can be cooled in the same manner as salmon.

A much better method is after dressing the fish as noted above, to put them on trays and run these into a retort or oven, whichever is most convenient, and heat the fish until a large part of the excessive moisture in the flesh has been removed and the skin is ready to peel off. After removal from the retort the skin is taken off and the body cut into pieces to fit the can, the loose rib bones removed with a pair of tweezers, the can filled and sealed, and then exhausted and processed as noted above. It is possible that the exhausting could be done away with after a little experimenting, especially if the meat was packed in half-pound cans. Some canners save the oil obtained in cooking the fish and put in the can with the flesh, which gives the latter the true cod flavor.

In corning the fish are dressed by having the head removed, the belly split to the vent and the gills and entrails removed. Some packers split down the back. The fish are then cleaned and wiped dry without the use of water. For each 100 pounds of fish the packer then mixes thoroughly 5 ounces of powdered saltpeter, 5 pounds of salt and 5 pounds of brown sugar, and rubs the outside and inside of the fish with the mixture. The fish are then placed in tanks, skin side down, several planks placed on top and these weighted down. They are allowed to remain here from 48 to 60 hours; the thicker the fish the longer the time. After removal from the tank and washing and draining the fish are cut to fit the size can in use and placed in the can. The can is then filled with a sauce made from the following materials and in the manner noted: ½ pound of whole cloves, ½ ounce of bay leaves and ½ pound of whole black pepper, and placed in 1 gallon of 60-grain vinegar and allowed to soak 48 or more hours. Two pounds of chopped onions and 3 pounds of salt are placed in a kettle with 12½ gallons of water and brought to a boil, after which it is cooked 30 minutes, the vinegar and spices then added. The mixture is allowed to boil one minute, after which it is strained.

The top is then sealed on tightly and processed at 240° F., 1-pound cans for 30 minutes and 2-pound cans for 45 minutes.

In canning codfish the can should be lined with parchment paper as otherwise the flesh will discolor.

CULTUS OR BLUE COD

This exceedingly common Pacific coast fish is found from Sitka to Santa Barbara, being especially abundant in lower British Columbia and the State of Washington, and is a quite important food fish. The demand for it is constantly increasing, but the fishermen could increase the catch a hundred-fold if there was sufficient demand to justify it.

The cultus cod (*Ophidion elongatus*) is a large, coarse fish, reaching a length of 3 to 4 feet, and a weight of 30 to 40 pounds. The flesh of the fish is livid blue or green in color, but turns white in cooking.

The following method might work in canning this species. Scale, dress and head the fish. Cut in pieces to fit can, and soak these in 50° (salometer) brine until blood has been extracted. Do not use the brine the second time. Put pieces in 1-pound cans with ¼ ounce of salt, put top on loosely, and exhaust for 15 minutes at 212° F. Seal tops and process cans for from 90 to 120 minutes (the time can be determined only by experiment) at 240° F. Remove from retort and cool in bath or with hose.

DRUM

The sea drum (*Pogonias cromis*) is found from New England to the Rio Grande, and is a common and well known fish on sandy shores everywhere, particularly southward. It is one of the largest food fishes on our coast, an example weighing 146 pounds having been caught in Florida. Though those seen in market usually weigh only a few pounds, examples weighing 50 to 80 pounds are not rare. The fish is a sluggish one, feeding chiefly at the bottom, where its long, sensitive barbels aids greatly in its search for food, which consists chiefly of crustaceans and mollusks.

In the south it is held in much esteem as a food fish. The flesh is coarse, though tender and of delicate flavor. In North Carolina it is frequently dry-salted and is then known locally as "North Carolina cod." The fact that muscle parasites are found in the posterior part of the back has militated against its more general use as a food fish. While these would not have a deleterious effect on the consumer, it is possible that they could be

eliminated in some way. The roe is considered a great delicacy and is often salted and dried, and also might be canned, the same method being used as is now followed with other fish eggs. The scales are used to some extent in Florida in the manufacture of the handiwork known as "fish-scale jewelry."

The drum is usually taken in seines or traps, while many are taken with hook and line.

The freshwater drum (*Aplodinotus grunniens*) is a large species occurring in our larger lakes and sluggish streams and bayous from the Great Lakes and west of the Alleghenies southward through the Mississippi valley to Louisiana, and in lowland streams through Texas to the mouth of the Rio Grande. It is most abundant in the Great Lakes and in the lowland streams of Louisiana and Texas. It is one of the largest of our freshwater fishes as it reaches a weight of 50 to 60 pounds and a length of 4 feet. The average, however, is much smaller. It is much esteemed as a food fish in the south.

This species has many common names. In the Great Lakes it is the sheepshead or freshwater drum; in the Ohio it is the white perch, gray perch, or simply perch; farther south it is drum, while in Louisiana it is called gaspergou.

In 1908 the production in the United States of saltwater drum amounted to 4,576,000 pounds, and of freshwater drum, 6,532,000 pounds.

These fishes would probably be best corned, the same as codfish, and then canned the same as the latter.

EELS

The common eel (*Anguilla chrisypa*) is one of the most familiar denizens of the waters of Eastern North America. On our Atlantic coast it ranges from Newfoundland to Mexico and Central America, and is also abundant amongst the islands of the West Indies. Unlike other eels, it ascends freshwater streams long distances, and may be found even in the headwaters of nearly all the rivers of the Atlantic coast and the Mississippi valley. They average about $2\frac{1}{2}$ to 3 feet in length.

The eel is a freshwater fish whose real home is in the fresh water rivers and lakes, but which runs down to salt water at spawning time. The common eel spawns in salt water, usually off the mouths of rivers, on mudbanks, to which they go in great numbers at the spawning time, which is in the fall. At the beginning of the second spring after the young eels find their way to the mouths of the rivers, which they ascend in incredible numbers. In these freshwater streams and lakes they remain until of adult age, when they return to the sea for spawning purposes. This seaward migration takes place in the fall, when large numbers are caught in eel traps, pots and other devices. The down-stream movement occurs usually at night, commencing soon after sunset, and ceases an hour or more before sunrise. Like the Pacific salmons, the eels die after spawning, never returning to fresh water the second time.

The common eel is remarkably prolific, as many as 10,700,000 eggs having been taken from a female.

The catch of eels in the United States in 1908 amounted to 3,358,000 pounds, but as the interior lakes and the upper courses of the rivers were not canvassed that year the above figures do not represent anything like the total quantity obtained by the fishermen. New York and Massachusetts lead with 736,000 and 722,000 pounds respectively. Owing to the popular prejudice against the eel as an article of food in certain sections, but little fishing is now carried on in these for the species, but this would be speedily overcome should a demand arise from the canning interests for them.

In Canada during the year 1916-17 the catch of eels amounted to 1,108,800 pounds, of which 874,100 pounds came from the Province of Quebec; 166,100 pounds from the Province of Ontario; 210,400 pounds from Nova Scotia; 147,900 pounds from New Brunswick, and 10,300 pounds from Prince Edward Island. As in the United States, the production can be much increased should the demand warrant it.

If canneries were located in suitable spots, say in Chesapeake Bay or the sounds of North Carolina, where eels are plentiful and cheap, quite a business could undoubtedly be built up in canning them smoked, pickled and in jelly.

Smoked

As soon as possible after received the eels are dressed by splitting them from the head to the vent and removing the viscera. Some continue the splitting sufficiently deep to remove the large vein along the backbone, but sometimes this may be pulled out without splitting the fish more than an inch or two beyond the vent; many smokers, however, pay no attention to this vein. The eels are then immersed in a strong brine (about 20 pounds of Liverpool salt, or other good salt, to 100 pounds of fish being required) from 2 to 7 hours, according to strength of brine, size of fish and the desired flavor. The thicker the fish the stronger the brine and the longer time required.

The eels are then taken out and dipped in water to remove the slime and surplus salt. Some throw them into a tub of water and beat them with a net for several minutes to accomplish this purpose. The eels are then strung on iron or steel rods, this passing through the head of each eel, or through the throat cartilage and out of the mouth, and hung in the open air a few hours for drying; some smokers transfer them immediately to the smokehouse.

In some places the fish are subjected to a mild smoke for about 5 or 6 hours until they have acquired the proper color, when the fires are gradually increased and they are hot-smoked or cooked for 30 or 40 minutes. Along the Great Lakes the smoking is usually at an even temperature throughout and continues for 6 or 8 hours. Mahogany or cedar sawdust is used for making the smoke, while hickory or white-oak wood is used for cooking, the latter being preferred. The smoking must be carefully attended to, for if the heat becomes too great the fish will curl up out of shape. A good test to determine whether the cooking is sufficient is to notice the ease with which the skin may be separated or peeled from the flesh where the eel has been split.

The percentage of decrease in weight by dressing and smoking is about 35 per cent.

Occasionally the eels are skinned before being smoked, the process being the same as above described, except that less salting and smoking is required, and it is also very difficult to keep them from falling down off the rods in the smokehouse.

The eels are then cut into lengths slightly less than the height of the can, and these pieces placed close together in the latter, the interstices being filled with diluted cottonseed oil suitably flavored with vinegar, cloves, etc., the top sealed on, exhausted about 10 minutes at 212° F., and then processed for about 100 minutes at 240° F.

Eels in Jelly and Pickled

Small and medium-sized eels are selected and after the head, skin and viscera are removed the eels are cut into suitable lengths and placed on wire trays and cooked in a steam retort, or, in some cases, fried in an oven for 20 or 30 minutes. They are then placed in cans, either plain or with a small amount of jellies to hold them firmly together, or with a sauce made of vinegar and spices, or in tomato sauce.

The jelly can be made by dissolving on fire isinglass which has previously soaked one day in water. Add salt and spices to taste, and flavor with port or sherry wine. The jelly should be clarified after being made.

The cans should then be sealed, exhausted for about 10 minutes at 212° F. if put in cans cold (no exhausting is necesary if product is packed hot), and processed for about 90 minutes at 240° F. The exact processing time can be determined by actual experiment.

FINNAN HADDIE

This special method of curing haddocks takes its name from the village of Findon (of which Finnan is a corruption), near Aberdeen, Scotland. At first it was a purely home industry, but as time went on the product became better known and the market expanded, until today the fish so prepared in various lands has a wide sale amongst fish lovers.

The business was first introduced into this country about 1850. Portland, Maine, was the scene of the first serious effort at the industry, and in this same city today the larger part of the present pack is prepared. Finnan haddie are also prepared at Eastport, Maine, New York City, and Gloucester, Mass., and at St. Johns and Digby in the British provinces.

When first caught the fish should be bled either by cutting the throat or by cutting one fold of the gill on each side of the head. If this is not done, and the landing of the fish is delayed for some days, the blood will be so thoroughly congealed in the bones of the fish that it will be next to impossible to extract it thoroughly, thus causing a general discolorment that will detract much from its value.

In dressing the head is first removed, following the shape of the gill cover. The fish should then be laid on its side upon a bench or table, its shoulders being towards the worker and its throat toward his right hand. Taking hold of the "lugs" of the fish with his left hand, the operator should insert the knife at the throat and run it down along the belly to the anal fin. The opening should be done by one forward sweep of the knife, and not by repeated cuts. The entrails are then removed. The fish should then be washed in clean water and the black membrane lining of the stomach removed.

In splitting the operator lifts the haddocks one by one with his left hand, laying each fish in front of him with its tail toward him. Taking a firm hold of the upper nape of the fish with his left hand, he enters the knife above the bone at the shoulder, and draws it down to within an inch of the tail, keeping the blade close to the bone during the operation, and taking care not to run the knife through the skin of the fish. This will make the fish lie out flat. If the blood bone has not been cut through the fish should be turned round and as much of the bone chipped off with the point of the knife as will expose the blood cavity. They are then given a thorough washing, especially on the inside.

The fish are then ready for the pickle, which should be strong enough to float a potato, or about 90° salometer. They should remain here for 20 minutes to half an hour, according to the size of the fish and the requirements of the market for which they are destined. They are then hung up on upright planks to drain and usually remain here overnight.

The smoking kilns are built on the general model of an open fireplace with chimney. The fish are fastened to the sticks from which they are suspended in the smokehouse, the napes being stretched out flat and pierced by two small iron spikes or nails in the smoke-sticks. Sometimes these sticks are used for the draining of the fish and then suspended

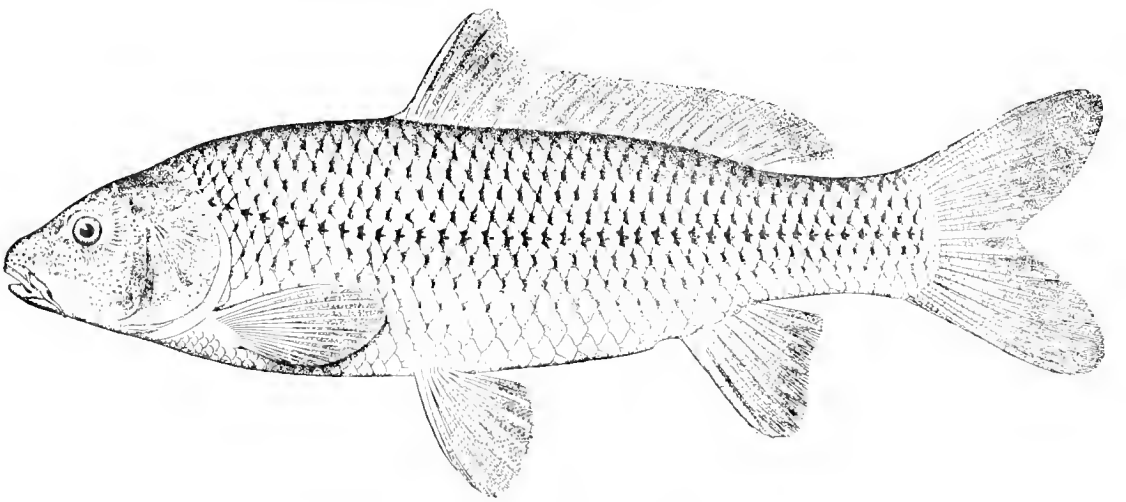
in the smokehouse, the sticks being placed in tiers, one above another, with space between to allow the smoke to circulate. A fire of hardwood, usually oak, is started over the floor of the smoking kiln and allowed to burn from 8 to 18 hours, when sawdust is applied, smoldering the fire and producing a dense smoke, which thoroughly impregnates the fish. In smokehouses with a low ceiling the smoking can be completed in 4 or 5 hours. In some smokehouses no wood is used, the curing being effected by burning hardwood sawdust, rock maple or beech being preferred, and the temperature is kept as high as practicable without burning the fish, which are placed high up in the bays. The time of cooking or smoking depends on the condition of the fish, temperature of the air, and the probable time to elapse before consumption, but never exceeds one night.

When the smoking is completed the fish are removed from the smokehouse and placed on racks for cooling, and when thoroughly cooled are packed for shipment. Only enough are cured at a time to supply the immediate demand, as it is important that they reach the retail dealers in good condition. During warm weather they will keep only a few days, but when the weather is cool they will, under ordinary conditions, keep from 10 days to 2 or even 3 weeks. If it is desirable to keep them longer they must be smoked much harder.

The season for Finnan haddie begins in October and lasts until the following April. 100 pounds of round fish yields about 55 pounds of smoked. The choicest haddie are tender. The inside is of a light yellowish-brown or straw-color.

As Finnan haddie when sold in boxes will keep but for a very limited period, efforts have been made at enclosing them in hermetically sealed packages. A popular package with some packers is the glass jar. The fish are cut to fit these jars, packed in, the jars sealed in vacuum, and then processed in a retort at about 240° F. for a period to be determined by experiment.

GERMAN CARP



SCALE CARP (*Cyprinus carpio*).

One of the most abundant of the freshwater species of this country is the German carp (*Cyprinus carpio*). This species is a very ancient one in Asia and Europe, and has been cultivated in ponds for many centuries; in Germany and Austria this is an important commercial industry. It was probably first introduced into this country by Mr. J. A. Poppe, of Sonoma, California, in 1872. In 1876-77 the U. S. Fish Commission began

the introduction of the species, and in a few years had distributed specimens throughout the country.

It was the intention to restrict the range of these fish to ponds, but as a result of freshets, accidents to dams, etc., many of them got into the rivers and large lakes, where they found conditions so propitious that they increased enormously in numbers.

Unfortunately our people took a dislike to the fish, due largely to the fact that it roots in the mud at the bottom of lakes and streams in its search for succulent roots, and this gives the flesh a muddy flavor if it is killed during the warm months. If marketed from October to April, however, the flesh has a fairly good flavor.

It is said that the carp may live to be 100 or even 150 years old and may come to weigh 80 to 90 pounds, but these statements are not well authenticated. They have attained in our waters a weight of fully 40 pounds. In warm waters in which plenty of food is obtainable the rate of growth of these fishes is remarkably fast.

While the carp is quite generally and abundantly distributed in our fresh waters, it is particularly abundant in Lake Erie, especially at the western end, Sandusky and Port Clinton, Ohio, and Monroe, Mich., being the principal shipping points, Lake St. Clair (at its upper end), and in the Illinois River. Should the demand arise almost any section of the country could produce large quantities of this species.

The carp thrives well under domestication. In ponds they become easily tamed, learn to come to a certain spot to be fed, and, it is said, will even take food from the hand. They are vegetable feeders and usually move in schools. In our southern states and California spawning often begins in April. Elsewhere the spawning season seems to be in the latter part of May and early June.

One objection to the use of the fish as food is that the flesh has a muddy flavor. This is true of those fish which have lived in very muddy places, especially where the water is stagnant and the temperature rather high. If the carp are removed from such places and kept for a short time in fresh running water, the muddy flavor it is claimed can be eliminated. Skinning the fish is also said to remove the undesirable flavor, which is thought to reside in the skin and fat immediately underlying it. Cutting off the head of the live fish and bleeding it is also said to work an improvement. At the principal fishery centers it is the custom to catch the fish with haul seines, and put them alive in ponds made by fencing off little bays or bights with narrow entrances, and keeping them here until the winter months, or until prices are sufficiently high to justify shipping. In cold weather the muddy flavor is absent, or but little noticeable, while the fish also commands a much higher price than it would bring during the summer and early fall.

In 1908 the total production of German carp in our waters amounted to 42,763,000 pounds, valued at $1,135,000. Of 38 states having fisheries of a commercial nature in that year, 31 reported German carp. Of the grand total Illinois reported slightly over one-half. The other leading producers were Ohio, Michigan, Missouri, Wisconsin, Iowa and Minnesota in the order named. California produced 427,000 pounds. Only a comparatively small catch is made in Canada. Since 1908 there has been a considerable increase in the demand for this species, with a corresponding increase in the production, although no authentic figures are available showing the exact extent of the increase.

If a market could be established for canned German carp the supply would be almost limitless. At the present time the Jews are the principal consumers, and they prefer the fish alive, or, if dead, in a round condition, or just as taken from the water. Whether they could be persuaded to take them canned could be determined only by experiment. There would be but little trouble in keeping the fish alive until it could be canned, as it is an exceedingly hardy species.

Some years ago a few carp were canned in Cleveland, but the process followed is not known. It is suggested that the fish be skinned, dressed and cut into pieces of a size to fit the cans, and after being thoroughly washed, put into clean, fresh brine made by dissolving 3 pounds of salt in each 12½ gallons of water used and left here until all the blood is extracted, usually from one to two hours. The pieces should then be put in the cans, the tops put on loosely, and the cans run through an exhaust box for about 10 to 15 minutes at 212° F., the tops then sealed on, and the cans processed for from 100 to 110 minutes at 240° F. for 1-pound cans (a little longer time for 2-pound cans), after which they should be removed and placed in cooling bath. A little experimenting will speedily disclose what changes, if any, are necessary in this process.

Canned Smoked Carp

Canned smoked carp might prove a very salable product. For smoking the larger fish are used, weighing usually 12 to 15 pounds. As these fish are not popular with the consuming trade it is probable that they could be bought by the canner at a fairly low price. With a sharp knife the skin and scales are cut off in broad strips (about three to a side), the cuts not going so deep, however, but that the imprints of the scales still show on the flesh. The head, viscera and fins are all cut away, and the fish is then cut up into transverse sections, some two or three inches in thickness. These steaks are placed in brine of 90° salinity to cover them and allowed to remain here from 10 to 16 hours, according to the strength of the pickle and the flavor desired. They are then strung on long iron rods, dipped in fresh water to remove surplus or undissolved salt, etc., drained and suspended in the smokehouse 4 to 8 feet above the floor, and subjected to a gentle smoke for 4 or 5 hours. The door or damper is then closed, the fires spread or built up and the fish cooked for one or two hours, according to the amount of fire, the height of the fish, and the particular cure desired. The cooling is accomplished by opening the doors of the smokehouse or by removing the fish to the outside.

They should then be canned the same as shown above, the packer being prepared, however, to alter the process as experience may show is necessary.

CATCHING GREYFISH FROM A PUGET SOUND WHARF.

GREYFISH

The writer hesitated long over including sharks and greyfish in his fishes suitable for canning, despite the fact that many have arisen to tell us they are excellent when so prepared. While the writer does not question that the flesh of these fishes fresh, smoked or salted is nutritious, and, no doubt, pleasing to many palates, it is still a question whether the flesh can be canned in such a way as to be palatable. Several Pacific coast salmon canners took up the business on a fairly large scale and with most disastrous financial results. Their failure was due exclusively to the fact that the flesh of these fishes contains a large percentage of urea.

The U. S. Bureau of Chemistry and private parties are now carrying on experiments looking to the elimination of the urea in the early stages of packing, and the results so far obtained have been fairly satisfactory, but, unfortunately, the flesh of the grayfish lacks the solidity found in the flesh of other fishes, and thus is unsuitable for canning whole, although it might be found suitable for canning in the shape of fish paste, loaf, or sausage.

One decided disadvantage, in a business way, to the canning of greyfish is that the patent desire of the fishery authorities and the fishermen generally is to exterminate the species altogether. In the marketing of a new canned food the first question the brokers and wholesalers, who in many instances bear all, or a considerable part, of the expense of introducing it to the consuming public, ask is as to the quantity that can be obtained and the permanence of the supply. The knowledge that the main desire of the authorities and fishermen generally is to exterminate the species, would cause most of them to refuse to put forth their best efforts to extend the demand for the product as they would soon be in the unenviable position of having created a demand they were unable to supply.

The name greyfish is now applied to two species of dogfish, which, while they resemble each other exteriorly, differ quite radically in composition of flesh.

The horned dogfish (*Squalus acanthias*) during the summer and fall months is abundant along the Atlantic coast from Newfoundland to Cape Cod, and during the winter occurs as far south as Cuba. They are strong and active swimmers, and roam along our coasts in great schools, pursuing their prey like a pack of wolves. In length the adults vary from 2 to 3 feet and in weight from 5 to 15 pounds. The horned dogfish is to be distinguished from the smooth dogfish by its small sharp teeth and a rather high dorsal spine in front of each of the two dorsal fins. Unlike most other fishes the eggs of the female are fertilized internally, and they develop inside of the egg tubes, and the young when born are similar to adults except in size. The flesh contains a large percentage of oil.

The schools of dogfish feed quite generally on mackerel, herring, cod, haddock and other coast fishes. When a school of these wolves of the sea appears upon the fishing banks they drive the food fishes away from them and the fishermen are compelled to suspend operations until they leave for other pastures. Not only do they destroy better food fishes, but they rob and injure or destroy the gill nets, seines, trawls and other gear of the fishermen.

The smooth dogfish (*Mustelus canis*) occurs in great numbers along our Atlantic coast from Cape Cod to Florida, and is found in the Pacific from Alaska to southern California. In this species the teeth are flat and pavement like, well adapted for crushing rather than for seizing and holding prey. The average length of the smooth dogfish is about 3 feet, but occasionally specimens are taken that measure as much as 5 feet. The mode of reproduction in this species is the same as with the horned dogfish.

It is a bottom feeder, preying almost entirely upon crabs, lobsters and other crustaceans. On the Pacific many are to be found under the fishhouses feeding upon the salmon refuse. It does not run in schools as does the horned dogfish. In composition the flesh of the smooth dogfish is free from oil.

Much is said of the abundance of greyfish, and while this may be, and probably is, true, it does not necessarily follow that many can be caught by the fishermen. On the Pacific coast the general experience of the fishermen has been that when first engaged in the fishery is quite productive, but in a few weeks the catch begins to dwindle rapidly until it is soon unprofitable, and the fishermen must then seek other grounds. The fishermen claim that the fish have not been caught out, but have migrated elsewhere to escape them, as they can usually be found in abundance beyond the range covered in the previous operations.

In both species the liver is exceedingly rich in oil, and has been put to a number of uses in the arts and sciences. It has also been refined for medicinal uses and is claimed by some to be as good as cod-liver oil.

The skin of the greyfish is durable, non-porous and covered with numerous small, pointed denticles closely set together, and has been used in various ways. Turners, cabinetmakers and carpenters and metal workers have used it for polishing purposes. In the East it is used for polishing ivory. In France the skin, when prepared with the placoid scales in place and dyed, usually green, is used for covering cardcases, jewel boxes, sword sheaths, desk ornaments, etc., and may also be used for covering the handles of swords and tennis rackets, on which it is desirable to get a firm grip. If produced in large quantities it would be a difficult matter to get much for them unless the present demand is largely increased.

It is possible that sizing might be prepared from the cartilaginous parts, but it is hopeless to expect to make a good glue from these parts.

The eggs are used for making puddings, pancakes, etc., and otherwise as a substitute for fowls' eggs.

GROUPERS

This, one of the most important genera of American fishes, comprises about a dozen species in our waters, most of them of large size and all valued as food.

The most important member of the group is the red grouper (*Epinephelus morio*). It is found on our South Atlantic and Gulf coasts from Virginia to Texas. It is a very handsome fish, and is one of the largest and most important food fishes of our tropical waters, reaching a length of 2 or 3 feet and a weight of 20 to 40 pounds. It is abundant on the west and south coast of Florida. It is most abundant, however, on the red snapper banks of the Gulf of Mexico, which it frequents in company with the former. It is much more abundant than the red snapper, which supports an important vessel fishery, but as it does not sell as readily as the latter the fishermen are limited as to the quantity they can bring in. They are caught with hook and line, the same as red snapper.

The rock hind (*E. adscensionis*) is known from southern Florida and the West Indies. It is common in rocky places, reaches a length of 18 inches, and is considered the finest food fish of the group. It is found mainly around Key West, and is taken with hook and line.

The Nassau grouper (*E. striatus*) is common all of the year around Key West. It attains a length of 3 feet and a weight of 50 pounds, although the average is more nearly 10 pounds. It is an excellent food fish.

The speckled hind (*E. drummond-hayi*) is most abundant on the red snapper banks in the Gulf of Mexico, and many are brought in to Pensacola by the snapper fleet. It attains a weight of 30 pounds.

A closely related species is the black jewfish or black grouper (*Garrupa nigrita*), which occurs from Charleston and Pensacola south. It is an immense fish, one of the largest known, reaching a weight of about 500 pounds, and rivaling in size the largest known examples of the spotted jewfish and the California jewfish. No small examples have ever been seen, only one weighing less than 100 pounds having been recorded. They are taken with hook and line, like all the rest, or with grains.

The spotted jewfish (*Promicrops itaiara*) rivals the black grouper and California jewfish in weight. It reaches 2 to 6 feet in length and occurs on both coasts of tropical America north of Florida and the Gulf of California.

These fishes can probably be canned in practically the same manner as red snapper and a large industry built up on the Gulf coast, as the red snapper vessels can catch almost unlimited quantities if they are assured of a market for them. The same plants could also can red snapper and several other species available in that section.

HALIBUT

The halibut (*Hippoglossus hippoglossus*) is found in all northern seas, and is one of the most valued food fishes of the world. In the North Atlantic it is found on the American side as far south as Montauk Point. Its occurrence south of 40° is unusual. Northward its range extends at least as far as Cumberland Gulf, in latitude 64°, and on the coast of Greenland to 70° north. It is abundant about Iceland and Spitzbergen, in latitude 80°. In the Pacific the halibut ranges from the Farallones to Bering Straits. The bulk of the world's supply of halibut comes from the banks along the Alaska coast; but little is now taken from the Atlantic banks.

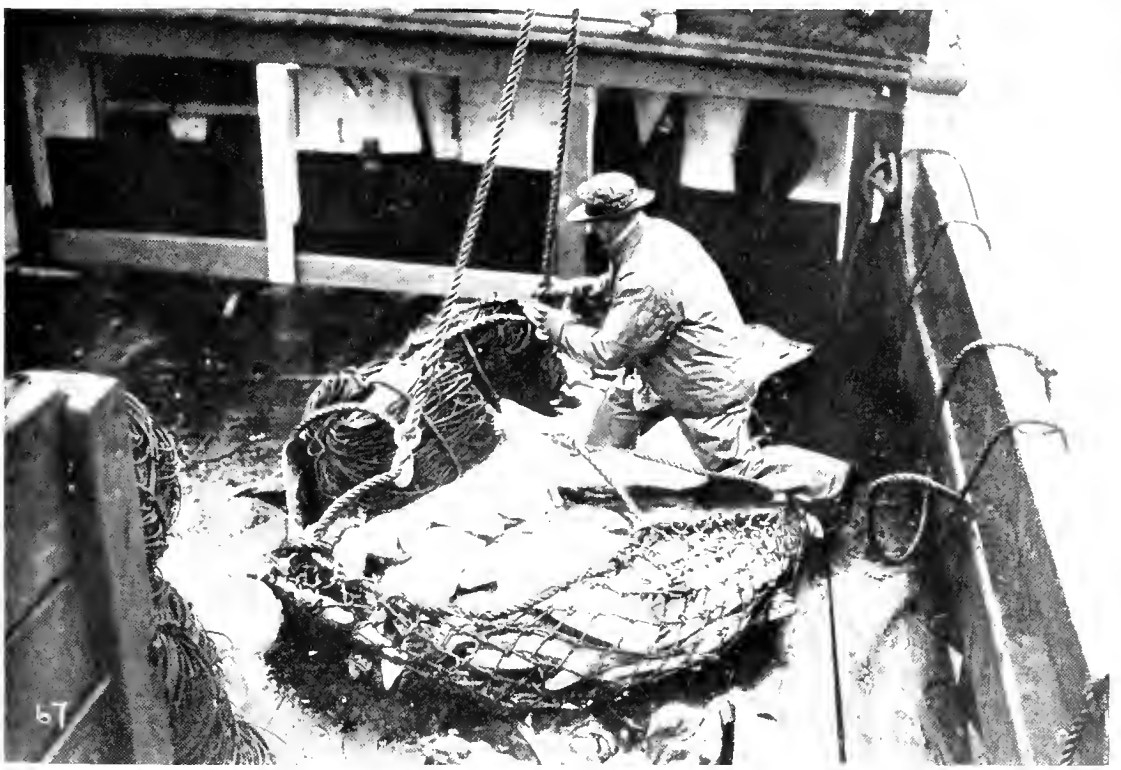
The halibut thrives best in the coldest waters. The temperature of the water in which it is taken rarely exceeds 45° F., and it is often as cold as 32°. It is one of the largest of fishes; the author saw one at Juneau, Alaska, about 1906, which weighed 365 pounds, while Nilsson records one from the coast of Sweden that weighed 720 pounds. The male halibut is always much smaller than the female, and rarely exceeds 50 pounds in weight. Very large fish are not so highly esteemed as those of smaller size. Those from 30 to about 100 pounds fetch the best price.

While the fishery is now insignificant on the Atlantic coast, the banks being nearly exhausted, it is one of the most important of our Pacific fisheries. A large fleet of steamers and power vessels, with headquarters at Seattle, Vancouver, Prince Rupert, Ketchikan, Petersburg, and Juneau, engage in the fishery throughout the year. In 1917 the American fleet operating on the Pacific banks caught 13,892,602 pounds, while the British Columbia fleet caught 9,710,030 pounds, a grand total for the Pacific of 53,602,632 pounds, as compared with approximately 3,712,164 pounds caught on the Atlantic banks during the same period.

By far the greater portion of the catch is marketed in a fresh condition, and a considerable part is shipped to the East. Some are frozen, while a very small portion is fletched. None are canned for market, although if properly managed a considerable trade could be developed along this line.

On our California coast, from Tomales Bay to Cerros Island, and along the coast of Lower California, is found the bastard halibut (*Prettichthys californicus*), which is really a flounder, although commonly marketed as halibut. It reaches a length of 3 feet, a weight of 50 or 60 pounds, and is quite common. It does not rank near as high

A DECKLOAD OF HALIBUT.



LANDING A SLINGFUL OF HALIBUT AND TWO SKATES OF GEAR ON DECK.

as the halibut as a food fish. In 1917 4,452,614 pounds were landed in California from the banks.

Considerable experimental work has been done in the canning of halibut, in several instances with marked success.

In one the fish were dressed and cut into pieces to fit the 1-pound cans, a little brine added, the tops put on loosely, and the cans exhausted for about 15 minutes at a temperature of about 210° F. They were then sealed up and cooked in a retort for about 80 minutes at a temperature of about 248° F.

In another the fish were first cooked the same as is done with tuna, the meat separated from the skin and bones, then put in the cans, the tops put on loosely, the cans exhausted and cooked as noted above. Some consider the exhausting unnecessary in this process.

The halibut have also been corned before being canned. In this process the fish, after being dressed, split into two halves along the backbone, and wiped dry, are thoroughly rubbed, inside and out, with an intimate mixture composed of 25 pounds of brown sugar, 25 pounds of salt and 1 pound 9 ounces of powdered saltpeter, to each 500 pounds of fish. The fish are then laid, skin side down, in tanks, and allowed to remain here from 50 to 60 hours, according to the thickness of the fish. They are then taken out of the tanks, washed and the moisture allowed to drain off them, after which they are cut to fit the cans, placed in same, which are then filled with a sauce made as follows: Soak ½ pound whole black pepper, ½ pound whole cloves and ½ ounce bay-leaves in one gallon 60-grain vinegar for 48 hours. Two pounds of chopped onions and 3 pounds of salt are then put in a kettle with 12½ gallons of water, brought to a boil and cooked for 30 minutes, after which the vinegar and spices are added, the whole mass allowed to boil one minute, after which it is removed and strained. The cans are then sealed and for 1-pound cans processed for 30 minutes at 240° F., and for 2-pound cans 45 minutes at the same temperature.

While oil can be used in the cans it does not present a very attractive appearance in contrast with the extreme whiteness of the meat. Tomato or mustard sauce can be used.

A comparatively small quantity of smoked halibut is packed annually in cans and jars. Fletches are used for smoking, and when needed they are removed from the kenches, washed thoroughly in fresh water with corn brooms or bristle brushes, and soaked in water for three or four hours. The water is then changed and they are again soaked for about the same length of time. This soaking is necessary in order to remove the coating of salt from the fish, and so soften its fiber that the smoke may easily penetrate the flesh. They are then water-horsed, skin side up, and with weights on top, for five or six hours, after which they are placed on flakes similar to those used in curing codfish. Here they are exposed to the sun's action for about 24 clear daylight hours, the fish being placed in small piles and covered with flake boxes during the night or in rainy weather. After drying the fletches are cut in small pieces, from two to six pieces to the fletch, with a gash in each piece where the flesh is thin and the skin appears tough.

The fletches are then strung on smooth, round, hardwood sticks or small iron or steel rods, the sticks passing through the splits or gashes cut in the fletches, each piece being two or three inches from the adjacent ones to permit the smoke to pass freely among them. The sticks with the fletches attached are then passed into the smokehouse.

There are a number of types of smokehouses, the descriptions of which do not come within the purview of this book.

The fuel for smoking consists principally of hardwood, chips of oak being especially good, with sawdust to smother the flames. Smoking is usually completed in from two

to five days. In damp weather moisture collects on the fish and the process may then require a week, while during the winter it is possible to keep the fires hotter, and the smoking may be completed in two days. The fires must not be allowed to get too hot, for then the fletches may become too soft to hang on the sticks, dropping to the floor. The doors are slightly open at all times to permit a circulation of air to keep the halibut cool, and they will also "take the smoke" better. One hundred pounds of fletches will yield about 82 pounds smoked.

The smoked halibut is then sliced in chips and packed in cans or glass jars. The containers are then sealed in vacuum and are processed for a period of from $1\frac{1}{2}$ to 2 hours (the exact time can best be determined by actual trial) in boiling water heated by steam. The cans may be cooled by spraying cold water over them after removal from the hot water, but the jars should be allowed to cool off 15 minutes in the bath.

HERRING

On the Atlantic coast the herring is one of the most abundant fishes inhabiting the North Atlantic Ocean. It ranges as far south as Cape Hatteras, but never occurs in great abundance south of Block Island, and the principal fisheries are north of Cape Cod. The northernmost portion of North America in which the herring fishery is persistently and extensively followed is Newfoundland, and there are likewise more or less extensive fisheries at the Magdalene Islands and at other places on the Gulf of St. Lawrence, while from the Bay of Fundy to Cape Cod the fishing grounds are pratically continuous.

On the Pacific *Clupea pallasii* is found from San Diego to the Arctic, being most abundant northward, where the bays and sounds are filled with them in summer. They are also to be found in these waters in lesser abundance throughout the rest of the year. In Alaska they usually spawn in the spring. They are fattest in the fall and early winter, and reach a length of 18 inches in certain sections of Alaska, but the average length is much less.

In California the herring is taken only from December to April, when it enters the sheltered bays to spawn. Its whereabouts is not known for the balance of the year. The California herring are small in size, but few of them reaching 10 inches in length.

The brush weir, a primitive form of the pound, or trap, net, is the principal form of apparatus used in the Atlantic fisheries. The fish are led into a large enclosure by means of long leaders and wings, which usually terminate in a funnel-shaped entrance. Their escape is prevented by the extension of these wings into the enclosure, thereby forming a triangular hook at the end of each, so that the fish, as they circle around inside the weir, are directed past the entrance. In some instances a drop, or curtain, made of netting is attached to each side of the mouth and when the fish have entered it is let down and closes the mouth of the weir.

Weirs are built in the spring, from April 1 to June 1. It is customary for a number of men, usually from two to five, to build, own and operate a weir together in equal shares.

As all parts of a weir are stationary it is necessary to use a seine, usualy a purse seine, for taking out the fish after they have been entrapped. The weir is fished at both low tides each day when the fish are running.

In a few places on the Atlantic coast gill nets are used for herring. The nets are always set at some distance below the surface. Gill nets are also used sometimes in Alaska and California. The cork lines are always at the surface. Purse seines are the

THE MAINE HERRING FISHERIES.

1. Dipping the Young Herring into Weir Boat; 2. A Maine Herring Weir; 3. A Maine Herring Smokehouse.

commonest form of apparatus used in Alaska, while purse and haul seines are used in other sections of the Pacific coast.

Herring were first canned in California in 1917, and the scene of operations was at Pittsburg, at the junction of the Sacramento and San Joaquin Rivers. As the product becomes better known the range of operations will doubtless be greatly extended. Owing to the smallness of the California fish, but few of them reaching 10 inches in length, they are better suited for canning than pickling.

Upon arrival at the cannery the herring are put through a revolving scaler and are then dressed by hand. After a thorough washing they are carried on belts through a drying chamber through which a blast of warm air is driven. This is to remove the excess moisture and to dry the surface of the fish so that they will present a more pleasing appearance and also so they will not disintegrate or shrink in the can. A suitable quantity of oil and spice or tomato sauce is then placed in the can, after which the fish are packed heads and tails alternately. From here they pass on an endless belt through an exhaust box for from 5 to 10 minutes at a temperature of about 210° F. The covers are then crimped on and the cans run into the retort, where they are cooked for about 90 minutes at a temperature of about 245° F.

A small quantity of herring are canned in Maine also, the method being very similar to that followed in California.

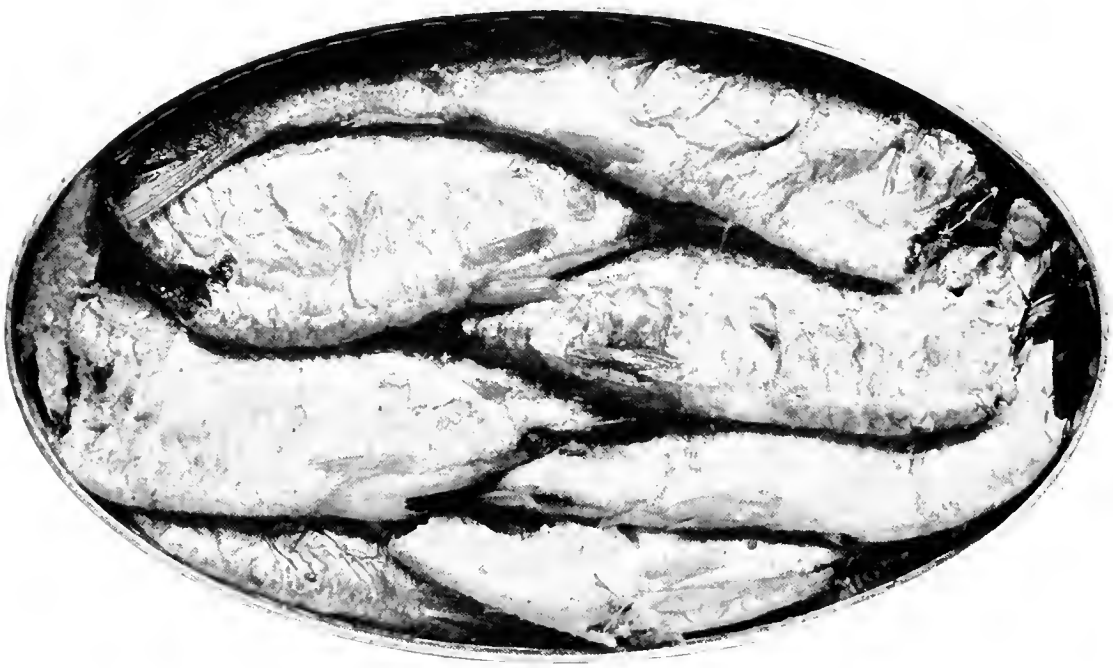
Some experiments in the canning of herring have been carried out at certain salmon canneries in Alaska. One canner packed some in ½-pound cans. The fish were dressed and cleaned, and then were cut down to fit the can, in which they were stood upright. The top was then put on loosely, after which the cans were turned over so the loose end would be on the lower side. In this condition they were run through the exhaust box, the packer claiming that by this method the excessive amount of water in the fish is drawn off and allowed to pass out, while the valuable natural oil of the fish is retained. After they leave the exhaust box the cans are reversed before they reach the double seamer. They are then processed the same as salmon.

THE ALASKA-PACIFIC HERRING COMPANY'S CANNERY AT BIG PORT WALTER, ALASKA.

Kippered Herring

Kippered herring have been canned in Maine in small quantities for some years. In 1916 the business began in Alaska. In the latter section when the herring are delivered at the cannery they are spread on the floor in a thin layer and sprinkled with salt, and they remain here until such time as the dress gang is ready to clean them. In dressing

the fish are placed on tables, around which gather the women, who cut off the head and remove the viscera. The fish are then thoroughly cleansed by being immersed in a 60° (salometer) brine for one to two hours. The fish are then removed, drained and taken to the smoking room, where they are hung by the tail on sticks studded on both sides with rows of sharpened nails. When filled with fish these sticks are placed side by side and tier above tier, the first one starting about seven feet above the floor of the smokehouse, where they are exposed to alderwood smoke over night, during which operation all



KIPPERED HERRING IN OVAL CAN.

the surplus moisture has been driven from the body and the natural oil commences to appear. They are then taken down and carried to the cannery where they are packed by hand in 1-pound oval cans; each can holds from five to eight fish. The cans are then sealed without the addition of any oil or dressing, and are cooked about 2 hours by immersion in boiling water heated by steam pipes to a temperature of 212° F.

In California the fish are dressed the same as for packing fresh, after which they are run through the dryer, then kippered, after which they are canned the same as fresh herring.

Smoked Herring

One Alaska canner in preparing fish in this manner dresses the fish by splitting them down the belly and removing the entrails. They are then put in brine for 30 minutes in order that the fish may be thoroughly washed and lightly struck. Should the tub, or tank, be well filled with fish it will be necessary to rouse them around considerably in order to make sure that the brine reaches all parts of the flesh. The fish are then drained until they no longer drip, when the belly is opened by the insertion crosswise of the fish of a short stick, and the herring are then hung up in the smokehouse. The smoking lasts about two days, and cottonwood branches and hardwood sawdust are used in the smoking.

After being smoked a sufficient length of time the fish are removed, split in two halves along the backbone, the head, tail and enough of the body cut off to permit of the fish fitting upright into the size can used. The skin is allowed to remain on the fish as it aids in retaining the moisture of the flesh and prevents the fish from getting too dry. In packing in the can half are put in head end down and the rest head end up, thus filling the can more uniformly. The cover is then put on and the can exhausted in the same manner as a can of salmon. After being sealed the cans are processed for 45 minutes at a temperature of 245° F.

Quite an important business is carried on in Maine, and occasionally at other places, in the packing of hard-smoked herring which have been skinned and boned. The fish are purchased from the smokers and then skinned, the head, viscera and backbone removed. The fish are then packed eight to twelve in small wooden boxes with glass fronts, or in glass jars. Another method is to put six bunches of a dozen fish each in neat wooden boxes. By skinning the herring and placing them together their flesh is brought in close contact, preserving their inherent moisture and flavor, this effect being further increased by placing them in a box. The best effect, however, is obtained by packing the fish in glass jars, as in these but little of the moisture in the fish will be evaporated. The fish also presents a much neater appearance in glass when offered for sale, and is more attractive to customers.

MACKEREL

The common mackerel (*Scomber scombrus*), one of the choicest of the world's food fishes, inhabits the North Atlantic ocean and on our coast ranges from Cape Hatteras to the Straits of Belle Isle. The species first appears in spring off Cape Hatteras, and later reach the shores of the Middle and New England States and Canada and Newfoundland, coming in from the sea from a southerly or southeasterly direction. They leave the coast in the same way in fall and winter. The mackerel is a wandering fish and its movement and the causes thereof are not fully understood. It is an abundant species on our Atlantic coast, although not so common as 30 or 40 years ago. The schools are frequently of great extent, swim at the surface or near to it, and in a rather compact body. However, periods of scarcity alternate with seasons of abundance.

The migration to our coast is for the purpose of spawning, and this season extends from May to July, June probably being the principal month. Most of the bays and sounds on the New England coast contain important spawning grounds. Prior to spawning, and for several weeks after, the mackerel are lean and poor.

The mackerel feeds upon the small crustaceans and other small animals which swarm in the sea. One of the surface swimming copepods, known as "red feed," is a favorite food; when mackerel have been feeding freely on it they spoil very quickly after being caught, owing to their sides rotting or "burning." The only way in which this can be avoided is by keping the mackerel alive in a corral until they have passed all the food in their stomach, when they can be killed with impunity.

On our coast the vessel fishery is carried on chiefly from Gloucester. The vessels go south in the early spring, falling in with the fish when they first appear off our southern coast, and landing their catch fresh at Philadelphia and New York. The fleet next seeks the school off the southern shore of Nova Scotia and follows it to the Gulf of St. Lawrence. Most of the fall fishing is done on the New England shore. Some of the finest fishing vessels in the United States are engaged in this fishery, and purse seines are used almost exclusively. The shore and boat fishery is carried on from New Jersey to Maine, the catch being usually sold fresh.

To the fishermen small mackerel are known as "spikes," "blinkers" and "tinkers." The former are the smallest caught by the commercial fishermen, they being five or six inches long and five to seven months old, or younger. Tinkers are under nine inches in length and are supposed to be about four years old. Blinkers are intermediate in size and age. Maturity is probably attained in the fourth year.

Certain of the sardine factories of Maine can small mackerel. In dressing these fish are split down the belly and the viscera, head and tail removed. The rest of the process is exactly the same as followed in packing sardines. The fish are generally packed with mustard, tomato sauce or spiced vinegar, the same as sardines, and then placed in oval-shaped cans holding from 1 to 3 pounds. They are sometimes placed in fancy glass receptacles and these are sold at high prices. A few cases are also prepared in the same size cans as sardines.

The demand for small packages of brine-salted mackerel led some years ago to the preparation of them in tin cans. In packing these the better grades, usually No. 2, are used. They are washed and scraped, to give them a neat appearance, and the heads and tails are cut off, and if large the fish are sometimes cut traversely in two pieces. In packing a small quantity of fine salt is sprinkled in the bottom of the can and the fish are carefully arranged flesh side up, except the top layer, which is placed flesh side down. A small quantity of salt is then sprinkled over the fish and the top is soldered on. The can is then completely filled with brine through a puncture about one-third inch in diameter which is made at the side of the can, after which a tin button is soldered over this puncture and the can is cleaned and labeled for market. A barrel of mackerel will "mess" about 180 pounds, which will fill three cases each containing one dozen 5-pound cans. This work is usually done at the salting houses.

The 5-pound cans are of two shapes, each of which is about $3\frac{1}{2}$ inches deep; the first is round and 9 inches in diameter, the second is oval and $6\frac{1}{2}$ inches wide and $9\frac{1}{2}$ inches long. In addition to the 5-pound cans, 3-pound, 4-pound and 10-pound cans are occasionally used. But few of these tins are now prepared owing to the scarcity of the mackerel.

The Chub or Tinker Mackerel

The chub or tinker mackerel (*Scomber japonicus*) is found on both coasts, in the Atlantic north to Maine, and to San Francisco on our west coast, although an occasional straggler has been reported as far north as Vancouver Island. The species has had a very erratic career in the Atlantic. Up to about 1840 it was apparently an abundant fish, but between 1840 and 1850 it seems to have disappeared entirely. But in 1879 a considerable school was seen at Provincetown. It again disappeared in 1880, but it is not rare at present.

In early spring on the Pacific large schools come up the coast and afford good sport for anglers. They are found in varying abundance until fall, when they leave for some unknown resort. Their average length is about 10 inches.

This species is an excellent food fish, and it is strange that so little economic use has been made of it heretofore. In 1917 the tuna canners began canning it and they have met with much encouragement in disposing of the pack.

Upon arrival at the cannery the fish are scaled, eviscerated, the head, ventral and pectoral fins with their supporting bones removed, then cut to fit cans, and the pieces put into a 75° (salometer) brine and allowed to remain here until the blood has been extracted from the flesh, or about 45 minutes, after which they are lightly rinsed in fresh water. The pieces are then put into the cans, care being taken to see that the cans are

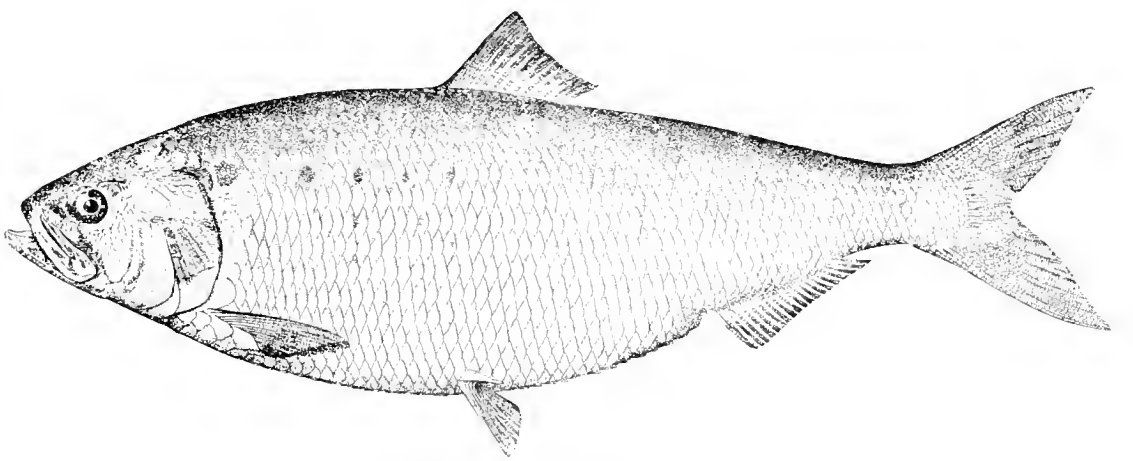
packed as tightly as possible and slightly above the top to allow for shrinkage in cooling. This is necessary in order that the pack may stand up well under long distance shipment.

The cans are then inverted and cooked in steam at 2 to 3 pounds pressure for 45 minutes. After removal from the retort the cans are allowed to drain 30 minutes or longer. The cans are then reversed and the pieces of backbone removed. This makes practically a boneless product and adds much to its value at but little cost. One-third to one-half fluid ounce of cottonseed or corn oil is then added. The cans are then exhausted for about 10 minutes at 212° F., sealed, and processed 1½ hours at 240° F., or 2 hours at 230° F.

Some canners pack in a bouillon. In this method the head and trimmings should be saved. In making the bouillon 10 gallons of the washed heads and trimmings should be placed in a soup kettle; to which add 12 gallons of cold water, 2 pounds chopped onions, a bunch of parsley, 1 pound of chopped carrots, ½ pound whole juniper berries, ¼ pound ground white pepper, 2 ounces ground red pepper. Bring to a boil then simmer gently one or two hours. The liquid should then be strained and 3 per cent. of salt added, when it is ready to be poured in the cans with the fish, in place of oil, after which the cans are handled the same as described above, except that they do not have to be exhausted if the bouillon is put in the can hot.

Quite small mackerel are obtained in considerable quantities, and these are prepared in the same manner as sardines, and packed either in oil, mustard or tomato sauce.

MENHADEN



THE MENHADEN (*Brevoortia tyrannus*).

The menhaden (*Brevoortia tyrannus*) occurs on our Atlantic coast from Nova Scotia to Brazil, and is by far the most abundant fish on our eastern coast. The migrations of this species appear to be largely dependent upon the temperature of the water, a temperature of above 51° F. being most favorable to them. They first appear in Chesapeake Bay in the early spring; on the coast of New Jersey in April and early May; on the coast of New England in late April and May; off Cape Ann about the middle of May, and in the Gulf of Maine in the latter part of May and the first of June. Returning, they leave Maine late in September or October; Massachusetts in October, November and sometimes December; Long Island Sound and vicinity in November and December; Chesapeake Bay in December, and Cape Hatteras in January. Farther to the south

they appear to remain more or less constantly throughout the year. The winter habitat of the northern schools is unknown.

The menhaden swim in immense schools, their heads close to the surface, packed side by side, and often tier above tier, almost as closely as sardines in a box. A gentle ripple indicates their position, and this may be seen at a distance of nearly a mile by the lookout at the masthead of a fishing vessel, and is of great assistance to the purse-seiners in setting their nets. At the slightest alarm the school sinks toward the bottom, often escaping its pursuers. Their movements are very capricious.

The chief importance of the menhaden is as an oil and fertilizer producer. The animal is exceedingly oily, and large factories are maintained solely for the extraction of the oil from it, and the use of the residue as fertilizer or fish meal.

At one time large quantities of menhaden were canned for food; in 1874 the production was about 500,000 cases. During this period they bore various fictitious names, such as "sea trout," "ocean mackerel" and "blueback mackerel," "shadine," "American Club-fish," and "ocean trout." Most of the producing plants were near Port Monmouth, N. J., while several of the Maine canneries have packed them at times. Goode in his "History of the American Menhaden," (page 137) gives the following description of the methods in use at one of these plants:

"We aim to have our catch of moss-bunkers in by 6 or 7 o'clock a.m., as the fish seem to be strongly impregnated with phosphorus and soon spoil in warm weather. As soon as the fish are landed, we put our entire force of men to cleaning, cutting and scaling, for which we have machines adapted. When the fish are cleaned they are at once put in hogsheads and salted just sufficiently to keep and to remove their extreme freshness. They are then packed in cooking cans, which are a little larger than the packing cans, and put into the tanks, where they are steamed for the space of about two hours. After the fish are taken out they are placed in the regular market cans, which are then laid upon zinc-covered tables, where they are filled with salad oil. They then go to the tinners, who solder on the lids, after which the can is again steamed and vented, and passed up into the cleaning and labeling room. Each day's work is piled up separately, each can being thoroughly tested to see that it is perfectly airtight. For this we have an experienced hand. At the expiration of this time, after being again tested, the cans are packed in wooden cases containing two dozen each, and are then ready for market. . ."

On pages 138-139 he gives another description of the process:

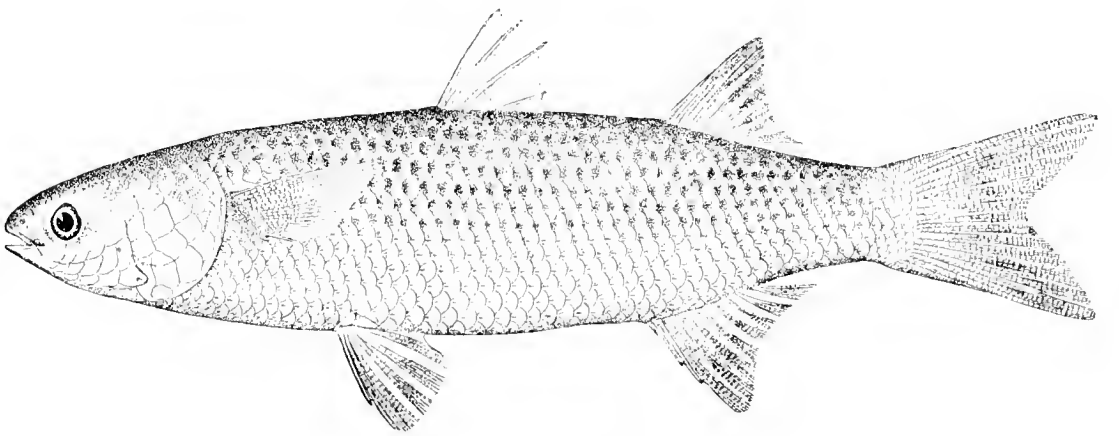
Mr. Barnet Phillips describes, in the New York Times, a visit to the "Ocean trout" manufactory at Port Monmouth. He writes: "If the name of the *salmonidae* be taken a little in vain, the trout manufactured out of moss-bunkers are by no means to be despised. 'Ocean trout' may not be the *garum* cooked with Tragasocan salt, but it is a fair fish-food and as an alimentary substance is in good demand. The process of manufacture is simple. The fresh fish are scaled by machinery, by means of a revolving wheel, are then cooked in steam, packed into boxes, which boxes have a cover put on them perforated with a couple of holes. The box containing only the fish is then plunged into a bath of pickle, where it remains until it fills itself, then the box, now full of fish and pickle, goes through a second cooking. When all hot, filled with steam, the two minute holes are closed with solder, a label is put on, and the moss bunker, now metamorphosed into 'ocean trout,' instead of being turned into oil or being employed as a top dressing for sterile soil. . . ."

From the above descriptions the modern canner can easily work out the process necessary for packing the fish in the modern sanitary can.

Immature menhaden can be prepared in the same manner as sardines, this having been done quite extensively in the early 70's.

The writer has eaten this fish canned and found it excellent, and there is no doubt that there would continue to be a big demand for it were it possible to use the old trade names under which it formerly masqueraded. Unfortunately, the consuming public associates the name menhaden with the oil and fertilizer obtained from the great bulk of the catch. As the fish has been blessed (?) with a large array of common names this handicap might be overcome by taking one of these. North of Cape Cod the name "Porgy" is almost universally in use. About Cape Ann "Hard-head shad" is in use, while in New York it is known as the "Moss-bunker." In Delaware Bay, the Potomac and the Chesapeake, among other names we find "Pilcher" and "Green-tail." From North Carolina to Florida "Fat-back," referring to the oiliness of the flesh, prevails.

MULLET



THE STRIPED MULLET (*Mugil cephalus*).

The striped mullet (*Mugil cephalus*) is found on the Atlantic coast from Cape Cod to Brazil, being exceedingly abundant along our South Atlantic and Gulf coasts. On the Pacific coast it occurs from Monterey to Chile. It is also found on the coasts of southern Europe and northern Africa. It goes in great schools and is everywhere abundant in bays, lagoons and sheltered waters. It averages about one foot in length and one pound in weight, but sometimes reaches a weight of from 4 to 5 pounds and a length of 2 feet.

The white mullet (*M. curema*) occurs from Cape Cod to Brazil on our Atlantic coast. It is abundant, especially in the tropics, and enters the sea more freely than the striped mullet, next to which it is the most important food species of the family in our waters.

The mullet catch of this country in 1908 amounted to 33,703,000 pounds, of which 24,582,000 pounds were taken from Florida waters. The next most important section was North Carolina, where 5,070,000 pounds were taken. In Florida the bulk of the catch is made on the west coast between the Punta Gorda region and Apalachicola, the fish literally swarming in all suitable places. The catch on the California coast in 1917 amounted to 61,328 pounds.

Mullets are caught in haul seines, gill nets, cast nets, pound nets, etc. Gill nets are the most productive.

Large numbers are salted for local use or shipment, but the bulk of the catch is packed in ice for shipment to northern towns and cities.

There are no particular obstacles, so far as known, in the way of canning mullet, and as the raw material would be both abundant and cheap, the only difficulty would be in finding a market for the product, and this ought not to be very difficult of accomplishment.

The fish should be scaled, the gills removed, the belly slit down to the vent and the entrails removed, and the body then cut to can lengths. The pieces should then be washed off in clean water and covered with a sufficient quantity of 50° (salometer) brine, in which they should be allowed to soak for one or two hours, according to the thickness of the fish, or until all the blood is extracted; the brine should be fresh made each time. The fish should then be placed in the cans, and the latter filled with brine made by dissolving 3 pounds of salt in each $12\frac{1}{2}$ gallons of water. The top should then be put on loosely and the can exhausted 10 minutes at 212° F., then sealed and processed about 60 minutes, the first 50 minutes at about 240° F., and the last 10 minutes at about 250° F.

It should be understood that the above are merely suggestions as to the proper process, and that exact methods will have to be worked out by experiment.

PADDLEFISH OR SPOONBILL CAT

The paddlefish, or spoonbill cat (*Polyodon spathula*), is probably the most singular looking fish found in our waters. It is a scaleless fish, with a body very much like the shark, with a low-browed, armor-plated head that runs forward into a broad, thin "paddle" of bone, constituting one-third the length of the entire fish. Its home is in the bayous and lowland streams and lakes of the Mississippi Valley, and here this remarkable instrument is doubtless used in turning up the mud at the bottom of the waters in which it lives, in searching for food. It reaches a great size and weight, specimens 6 feet 2 inches in length and weighing $122\frac{1}{2}$ pounds being known, although the average is more nearly around 30 pounds.

The species was considered worthless from a food standpoint until about 20 years ago, when the sturgeon fishermen who were seeking a substitute for sturgeon eggs in making caviar, the latter having become quite scarce through excessive fishing, discovered that the eggs of the paddlefish very much resembled sturgeon eggs both in appearance and flavor, also that the flesh made a very good substitute for sturgeon flesh. Since then an important fishery has been prosecuted for the species and much flesh and considerable quantities of eggs have been prepared and marketed each season. The flesh is prepared in the same manner as sturgeon flesh and the same method of canning can be followed.

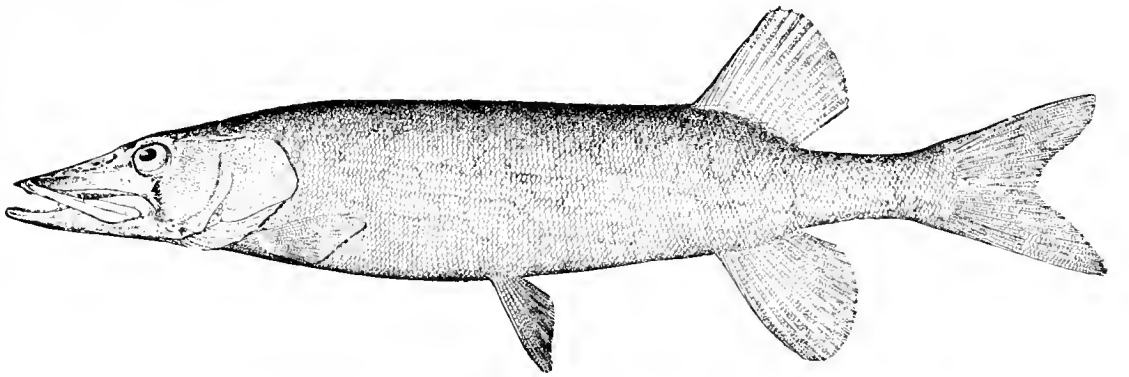
The fish is caught usually with set lines or in haul seines.

PIKE-LIKE FISHES

In our fresh waters are to be found a number of species of fishes, some of which are true pikes, while the others resemble pikes. These are nearly all excellent food fishes, and some of them are very important commercially. They are all good for canning and have been grouped together under one heading for convenience.

The common pike or pickerel (*Esox lucius*) is the most widely distributed and most important species of the family. It is found in all suitable fresh waters of northern North America, Europe and Asia. On this continent it is found from New York and the

Ohio River northward. It is not found on the Pacific coast except in Alaska. In the small lakes of the upper Mississippi Valley, and in the Great Lakes, it is generally common. It is a common fish in Canada. It reaches a length of 4 feet and a weight of 40 pounds or more.



THE EASTERN PICKEREL *(Esox reticulatis)*.

The common eastern pickerel or jack *(Esox reticulatis)* is found from Maine to Florida, Louisiana, Arkansas and Tennessee, common everywhere east and south of the Alleghanies. It is a common and familiar inhabitant of nearly every lake and pond in New England, New York, New Jersey and eastern Pennsylvania. It is also found in the lakes of eastern Canada. This species attains a length of 2 feet and a weight of several pounds. It is fished for in all sorts of ways. In winter many are taken through the ice by using live minnow bait. Its flesh is firm and flaky and possesses a pleasant flavor.

The total quantity of pike and pickerel taken in the waters of the United States by commercial fishermen in 1908 amounted to 2,959,000 pounds, 2,142,000 pounds of which came from the Great Lakes. Pound nets, seines, fyke and hoop nets and gill nets take the bulk of the catch. Ohio fishermen operating mainly in Lake Erie, took 1,118,000 pounds, while those of Michigan and Minnesota caught 478,000 pounds and 351,000 respectively. In 1916-17 the Canadian fishermen marketed 10,542,800 pounds of pickerel, with the prospect of very large increase as means of transportation to its many inland lakes are developed. These came mainly from Manitoba, Ontario, Saskatchewan, Alberta and Quebec.

Muskallunge

The muskallunge or maskinonge *(Esox masquinongy)* is native to all the Great Lakes, the upper St. Lawrence River, certain streams and lakes tributary to the Great Lakes, and in a few lakes in the upper Mississippi Valley. It also occurs in Canada north of the Great Lakes, also in Manitoba. It is not very abundant anywhere.

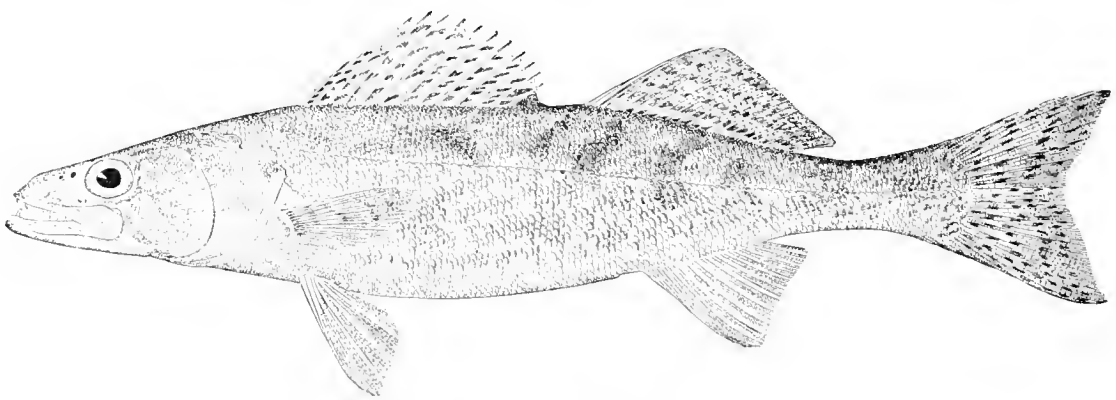
The Chautauqua muskallunge *(E. ohioensis)* is found in Chautauqua Lake and the Ohio basin. It is quite abundant in the lake, where it is taken by trolling. It is said to reach a length of 5 feet.

The total catch of muskallunge in the United States in 1908 amounted to 250,000 pounds, while the catch in Canada during the year 1916-17 amounted to 9,300 pounds.

Pike-Perches

The wall-eyed pike or pike-perch *(Stizostedion vitreum)*, while not related to the pikes in any way, has a body resembling that of the pikes, and is frequently found in

company with them, and could be canned in the same way. This species has a wide distribution. It is found from Lake Champlain westward throughout the Great Lakes region and to Assiniboia. It is native also to the small lakes of New York and the Susquehanna and Juniata Rivers, east of the Alleghanies, where it is known as jack salmon. In the Mississippi Valley it occurs in many of the larger streams and small lakes as far



THE WALL-EYED PIKE *(Stizostedion vitreum)*.

south as Georgia and Alabama, where it is known as salmon. In Canada, besides the Great Lakes region, it is found in the Hudson Bay region and Labrador. It is preferably a fish of the lakes, and it reaches its greatest abundance in the Great Lakes, particularly in Lake Erie. In Lakes Erie and Ontario is found the blue pike, supposed by fishermen to be a distinct species, but which is really the young of the wall-eyed pike.

The species ranges greatly in size, the maximum length being about 3 feet and the maximum weight about 25 pounds. The average is very much less. The flesh is firm, flaky and white, and of delicious flavor.

The sauger, or sand pike (*S. canadense*), is found from the St. Lawrence westward through the Great Lakes and in the Mississippi Valley west to Montana and south to Tennessee and Arkansas. It is especially abundant northward, in the St. Lawrence and the Great Lakes. In Canada, besides the Great Lakes, it is found in waters of Manitoba and perhaps Saskatchewan. The sauger is a much smaller fish than the wall-eyed pike, its length seldom exceeding a foot or 18 inches, and its weight a pound or two.

The catch of pike-perches in the United States in 1908 amounted to 15,247,000 pounds. Of the total amount, 15,115,000 pounds were taken in the Great Lakes. Over half of the total catch was taken by the Ohio fishermen operating in Lake Erie. The fish are taken principally in gill nets and pound nets.

In Canada during the year 1916-17 the catch amounted to 7,399,300 pounds, mostly from Manitoba, Ontario, Saskatchewan, Alberta and Quebec.

Canned

To can these fishes they should be scaled, the gills taken out, the fish split down the belly to the vent and the entrails removed, the fins cut off and the fish cut to the length of the can to be used. Wash the pieces in clean fresh water, and then place in a tub or tank and cover over with a quantity of 50° (salometer) brine, made fresh each time, in which one-half to one per cent. of alum has been dissolved (the flesh of freshwater fishes is generally softer than that of saltwater species, and the alum is for the purpose of hardening the flesh) and soak until all the blood has been extracted, which usually

requires from one to two hours. The fish are then placed in the can, which is filled with brine (3 pounds of salt to 12½ gallons of water), or some sauce, the top put on loosely, exhausted 10 minutes at 212° F., the top then sealed, and the cans processed about 55 minutes at about 245° F.

Smoked and Canned

These fishes are excellent smoked and then canned. In this event the fish should be split down the belly and the entrails removed, the fins cut off, but the head allowed to remain on. They are then washed thoroughly and packed in tubs, about four pounds of fine salt to 100 pounds of fish scattered among them, and sufficient brine of 90° salinity to cover them. From one-half to one per cent. of alum should be added to the brine for the purpose of hardening the flesh. Either dry salt or brine alone may be used, the former being preferred in warm weather and the latter during the winter. In case brine alone is used, some dry salt should be placed on top to strengthen the weak pickle floating at the surface. After remaining in the pickle for several hours, depending upon the strength of the pickle and the flavor desired, the fish are removed and strung on smoke rods, the rods passing in at the right gill opening and out at the mouth. Several other appliances for holding the fish may be employed, if desired. If it is desired to have the fish well smoked on the inside, small wooden sticks should be used to keep the abdominal cavity stretched open.

Unless they have been rinsed before stringing, the strung fish are dipped in fresh water to clean them, drained and suspended in the smokehouse four to eight feet above the floor, and subjected to a gentle smoke for four or five hours. The door or damper is then closed, the fires spread or built up and the fish cooked for one or two hours, according to the amount of fire, the height of the fish and the particular cure desired. After cooling, which is accomplished either by opening the doors of the smokehouse or by removing the fish to the outside, the head is cut off, the fish cut in lengths to fit the can, placed in same dry, and the tops sealed on. They are then exhausted 10 minutes at 212° F., and processed at 240° F., 1-pound cans 30 minutes, 2-pound cans 45 minutes. Some canners fill the interstices of the can with either brine, oil or sauce.

PINTADO AND CAVALLA

In the neighborhood of Key West are found two species of fish, the pintado (*Scomberomorus regalis*) and the cavalla, or kingfish (*S. cavalla*), which closely resemble each other, and are near relatives of the Spanish mackerel. The pintado is found from Cape Cod to Brazil, but is not common anywhere except about Florida and Cuba. It grows to 5 or 6 feet in length, 20 pounds or more in weight, and is an excellent food fish. It is most abundant around south Florida and is caught by trolling.

The cavalla is a fish of the tropical seas, often coming in immense numbers to the coasts of Florida and the Carolinas. It is common on our South Atlantic coast and among the Florida keys; it is one of the most important food fishes in the Key West markets. It usually appears in November and remains until April, during which time it is caught by trolling. As a food fish it takes a very high rank, the flesh being firm and of excellent flavor. The cavalla reaches a length of 5 feet and a weight of 100 pounds, while examples weighing 40 to 50 pounds are not rare. The average size, however, of those taken about Key West is only about 10 pounds, or perhaps even less. In 1908 the fishermen caught 1,564,000 pounds of cavalla, of which 1,435,000 pounds were taken in Florida. This does not begin to represent the possibilities of the fishery as the market at that time for the fish in a fresh condition was very limited.

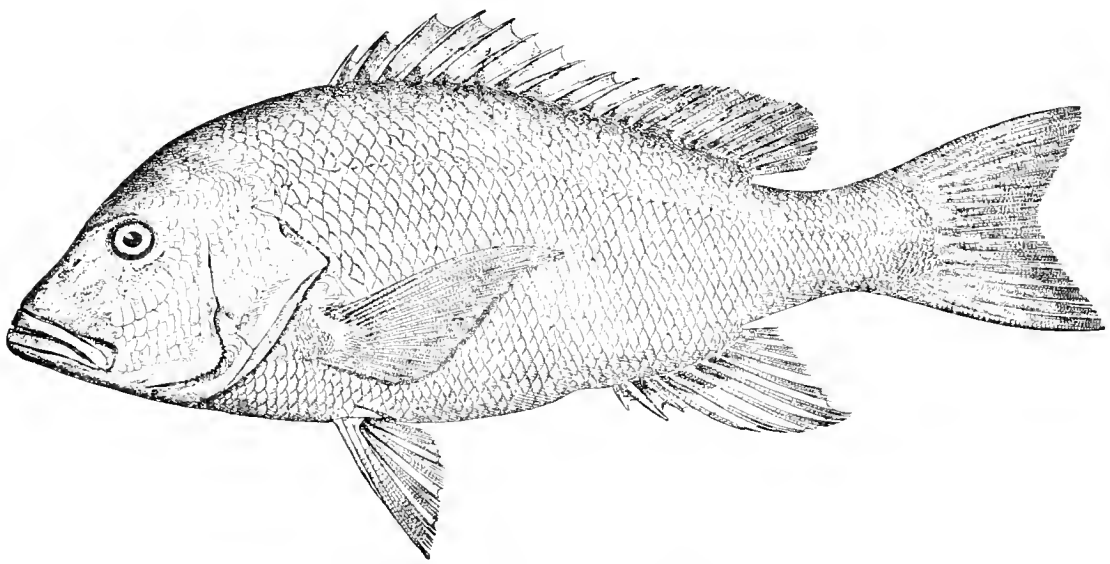
Neither of these fishes have been canned for market as yet. It probably would be a comparatively simple matter to so preserve, and would suggest the following trial method, which may be altered as experience indicates is necessary.

The fish should be scaled and dressed, the head and tail removed, and the body cut into lengths to fit the cans, and thoroughly washed off in clean water. The pieces should then be covered with a 60 (salometer) brine and soaked until all the blood is extracted, usually one or two hours, according to the thickness of the fish. This brine should not be used the second time.

The pieces should then be put into the cans, with $\frac{1}{4}$ ounce of salt, and if the sanitary can is used, the top should be put on loosely and the cans run through the exhaust box for 10 or 15 minutes at 212° F., the top then sealed on and the fish processed in the retort for 90 minutes at 240° F., after which they should be removed from the retort and placed in the cooling bath.

It undoubtedly would improve the flavor of both fishes if they were lightly smoked before canning.

RED SNAPPER



THE RED SNAPPER *(Lutianus aya)*.

The red snapper (*Lutianus aya*) is undoubtedly the handsomest of all our food fishes, being a brilliant red in color, and in addition is one of the most important economic fishes of the United States. Its range extends from Long Island to Brazil, but the center of abundance is in the Gulf of Mexico, in rather deep water on the rocky banks off the coasts of Campeche and Yucatan. It is fairly abundant off the east coast of Florida and the coast of Georgia. The bulk of the fishery is centered at Pensacola, from whence a considerable fleet sails to the banks. A few vessels also have headquarters at Mobile, New Orleans, and Galveston.

The red snapper reaches a length of 2 to 3 feet and a weight of 10 to 35 pounds. They are caught with hand lines alone, and these are worked from the deck of the vessel, the latter being either anchored on the bank or else allowed to drift broadside across it.

In 1908 the catch of red snappers amounted to 13,498,000 pounds, valued at $636,000. The fishery was confined to Florida, Alabama, Texas, Georgia and South Carolina, their importance being in the order named.

At the present time practically all of the red snappers are marketed in a fresh condition, but a few experiments have been undertaken looking toward the canning of the surplus. A plant established to handle this species could also handle groupers, which frequent the same banks, and unlimited quantities of which could be brought in by the red snapper fishermen.

The following method would probably be found suitable for this species: The fish should be scaled, eviscerated and the head removed. It should then be put in a 60° (salometer) brine and left here until all the blood has been extracted. The brine should be made fresh each time. The fish should then be cut into can sizes and packed in the receptacles with ¼ ounce of salt added, the tops put on loosely, and the cans exhausted for from 10 to 17 minutes at 210° F. The tops should then be sealed tightly and the cans processed from 100 to 120 minutes at 240° F., or a little shorter time if the temperature is at 245° F.

It is possible that both the red snapper and grouper could be kippered before being canned.

ROCKFISHES

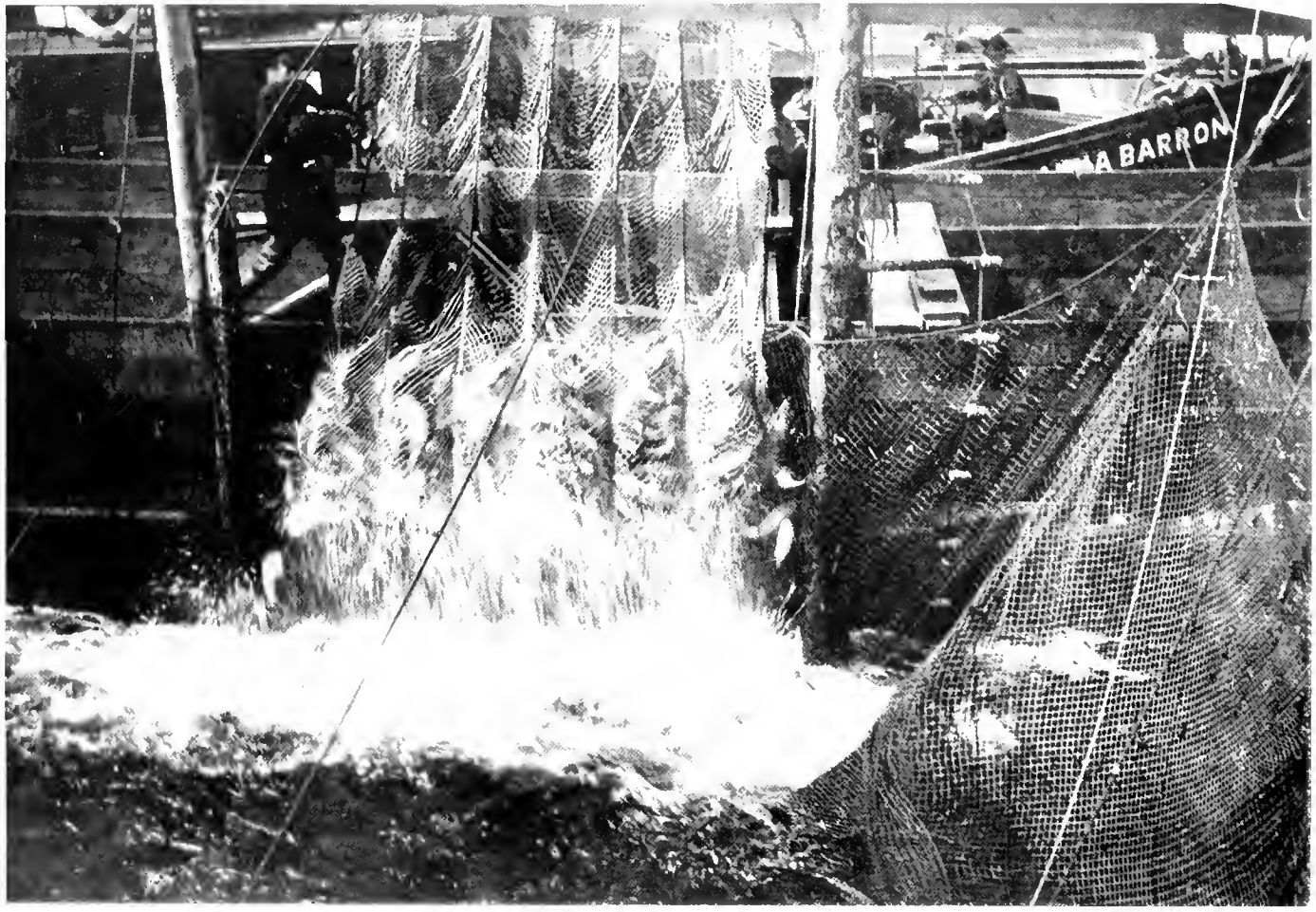
On our Pacific coast is found a group of fishes, of the genus Sebastodes, the members of which are commonly known as red rockfish, red rock cod, orange red rockfish, yellow-backed rockfish, Sitka "black bass," which is steadily increasing in popularity. Nearly all are to be found in abundance from Alaska to Lower California. They range fairly large in size, some of them attaining a length of nearly 3 feet and a weight of many pounds. They are caught at present mainly with hook and line, but the otter trawl could be used with much effect as the fish are bottom feeders. At present the supply is far in excess of the demand, and it is possible a market might be created for them in a canned condition. The flesh is white and flaky, and it ought to be possible to can them by the same process as followed in canning red snapper.

SALMON

One of the most important things for the cannerymen to know is where and when the different species of salmon are to be found. As each species forms a different grade, the value of which vary much in the markets, and as they do not all appear in the same abundance or all run together in the same waters, the canner who wished to pack a certain grade would naturally select a location along the waters in which that species was most abundant.

Five species of salmon (*Oncorhynchus*) are found in the waters of the North Pacific, ranging northward from Monterey Bay on the American coast and Japan on the Asiatic, the extreme northern distribution of certain of the species having not yet been accurately determined. The five species are: (1) *Oncorhynchus tschawytscha*, quinnat, tyee, chinook, spring or king salmon; (2) *Oncorhynchus nerka*, blueback, red, sukkegh or sockeye salmon; (3) *Oncorhynchus kisutch*, silver, coho or white salmon; (4) *Oncorhynchus gorbuscha*, humpback or pink salmon; (5) *Oncorhynchus keta*, dog or chum salmon.

In addition the steelhead trout (*Salmo gairdneri*) is classed as a salmon by the commercial fishermen.



BRAILING SALMON FROM A FISH TRAP.

Chinook, Quinnat or King Salmon

The largest, best known and most valuable of these is the chinook or king salmon (*O. tschawytscha*). It is found throughout the region from the Ventura River, Calif., to Norton Sound, Alaska, and on the Asiatic coast as far south as Northern China. As knowledge extends, it will probably be recorded in the Arctic.

In the spring the body is silvery, the back, dorsal fin and caudal fin having more or less of round black spots, and the sides of the head having a peculiar tin-colored metallic luster. In the fall the color is, in some places, black or dirty red. The fish has an average weight of about 22 pounds, but individuals weighing 70 to over 100 pounds are occasionally taken. The Southeast Alaska fish average as high as 23 pounds in certain seasons, followed by an average of about 22 pounds in the Columbia River, and about 16 pounds in the Sacramento.

In most places the flesh is of a deep salmon red, but in certain places, notably Southeast Alaska, Bristol Bay, Puget Sound and British Columbia, many of the fish, the proportion being sometimes as much as one-third of the catch, have white flesh. A few examples have been taken with one side of the body red and the other white, while some are found with mottled flesh. No reasonable explanation of this phenomenon has yet been given.

In its southern range the quinnat strikes in at Monterey Bay in sufficient numbers to justify commercial fishing about the middle of April, where it is seen feeding upon the inshore moving schools of herring and sardines, continuing until in August. There are two runs of spawning fish in the Sacramento, the first or "spring run" beginning in April and continuing throughout May and June, these fish spawning mainly in the cold tributaries of the Sacramento, such as the McCloud and Fall Rivers. The second or "fall run" occurs in August, September and October, and these fish spawn in the riffles in the main river between Tehama and Redding, also entering the tributaries in that vicinity. The two runs merge into each other. It is claimed that there is a third run which comes in December.

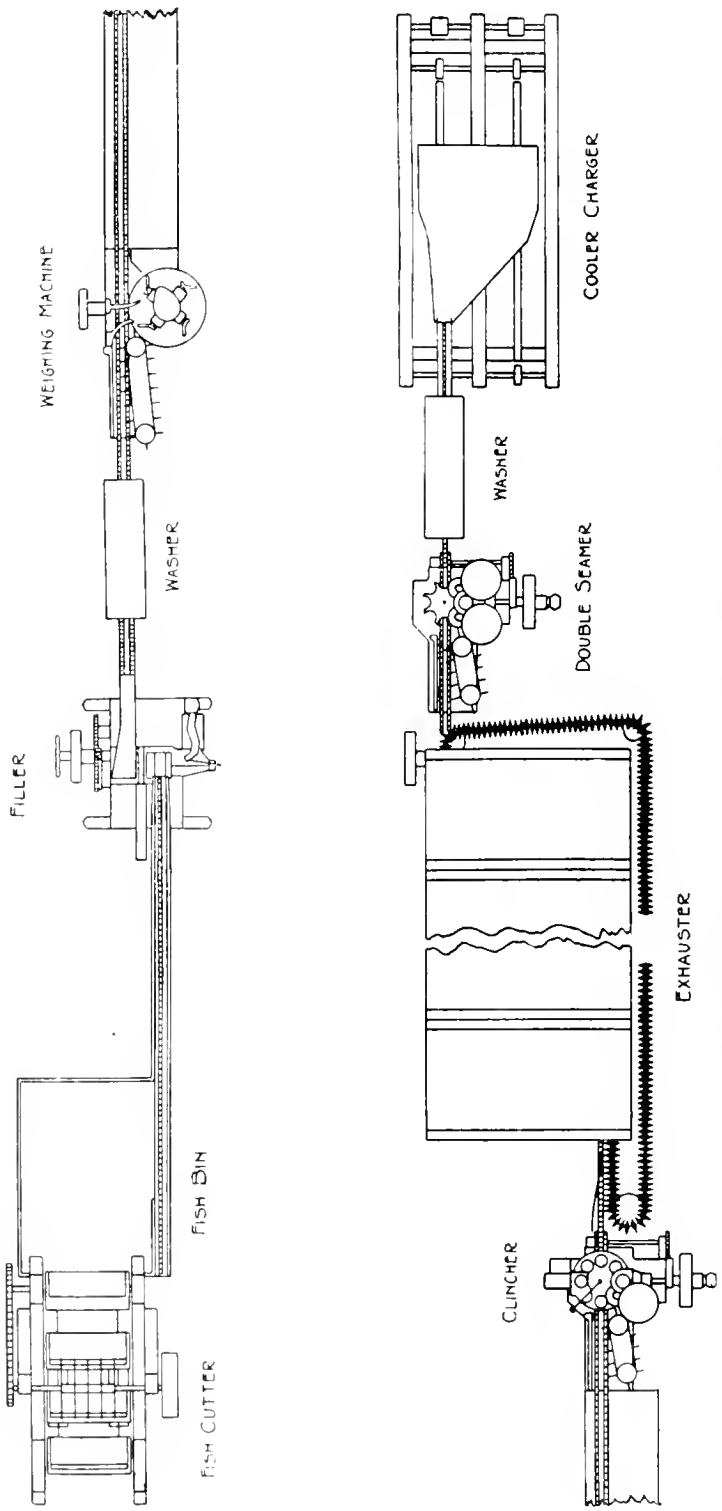
The Eel and Mad Rivers of Northern California have only a late or fall run, while the Klamath River has both a spring and a fall run, and Smith River has a spring run alone. Rogue River in Oregon has a spring and a fall run, and the Umpqua and several other coast streams of Oregon have small early runs.

The Columbia River has three runs, the first entering during January, February and March, and spawning mainly in the Clackamas and neighboring streams. The second, which is the best run, enters during May, June and part of July, spawning mainly in the headwaters. The third run occurs during late July, August, September and part of October, and spawns in the tributaries of the lower Columbia.

In Puget Sound chinook salmon are found throughout the year, although it is only during the spawning season that they are very abundant. In the Fraser River, a tributary of the sound, the run occurs from March to August.

In the Skeena River, British Columbia, the run occurs from May to July, the same being approximately true of the Nass also.

In Southeast Alaska they are found all the months of the year. From March to the middle of June they are abundant and feeding in the numerous straits and sounds; in May and June the spawning fish enter the Unuk, Stikine, Taku, Chilkat, Alsek and Copper Rivers in large numbers, and in a few smaller streams in lesser abundance. In August, September and October they are again to be found in large numbers feeding in the bays and sounds, while during the winter months a few have been taken on trawls set for halibut, showing that they are living in the lower depths at this time.



FLOOR PLAN OF COMPLETE LINE OF SALMON CANNING MACHINERY

(In actual practice it would be one continuous line, the lower line being joined onto the end of the upper)

In Cook Inlet the run occurs during May and June and is composed wholly of red-meated fish; in the rivers of Bristol Bay the run comes in June, and the same is true of the Togiak, Kuskokwim and Yukon Rivers, although fish may be seen in the upper courses of the Yukon in July, the lateness here being due to the immense distance the fish have to go.

On the Asiatic side the Chinook is found in some of the rivers of Siberia.

Owing to their special suitability most of the chinooks are now marketed in either a fresh, frozen or mild-cured condition. The principal canning is done on the Columbia River and along the Oregon and California coasts. A few are canned along the rest of the coast, but the price obtained for the canned product is, under normal conditions, so low that the canners find it almost impossible to compete with the fresh fish buyers and mild curers. But very few white-meated kings are canned now. As it is a difficult matter to dispose of these in any other condition except at a greatly reduced price, it is to be hoped that the market for them canned will be expanded, thus furnishing a much needed profitable outlet for them.

Sockeye, Blueback or Red Salmon

The sockeye, red or blueback salmon *(O. nerka)*, which forms the greatest part of the canned salmon of the world, when it first comes in from the sea, is a clear bright blue above in color, silvery below. Soon after entering the river for the purpose of spawning, the color of the head changes to a rich olive, the back and sides to crimson and finally to a dark blood red, and the belly to a dirty white. The maximum weight is about 12 pounds, and length 3 feet, with the average weight about 5 pounds, varying greatly, however, in different localities. A run of small, or dwarf, males accompanies certain of the main runs, these being especially noticeable in the Chignik lagoon, Alaska, run. This species usually enters streams with accessible lakes in their courses.

A few specimens of the sockeye have been taken as far south as the Sacramento River. In Humboldt county, California, small runs are said to occur in Mad and Eel Rivers. Only an occasional specimen appears in the coastal streams of Oregon. The Columbia is the most southern river in which this species is known to run in any numbers, entering the river with the spring run of chinooks. From here south the species is called blueback exclusively. A considerable run enters the Quinniault River, Washington, and there is also a small run in Ozette Lake, just south of Cape Flattery.

In the Puget Sound region, where it is known as the sockeye, this species ascends only the Skagit River in commercial numbers, although a small run appears in the Lake Washington system of lakes and, possibly, in the Snohomish, Stillaguamish and Nooksack Rivers.

The greatest of all the sockeye streams was the Fraser River, British Columbia, and this stream was famous from very early days for its enormous runs of this species, a peculiar feature of which is that there is a marked quadriennial periodicity in the run. The maximum occurs the year following leap year, the minimum on the year following that. The greater part of the catch of the Puget Sound fishermen is made from this run as it is passing through Washington waters on its way to the Fraser. The fish strike in during July and August on the southwest coast of Vancouver Island, apparently coming from the open sea to the northwest. They pass the Straits of Juan de Fuca, Rosario and Georgia, spending considerable time in the passage and about the mouth of the river. Small numbers run as early as May and as late as October, but the main body enters about the first week in August. The run has of recent years dwindled until it is now but a fraction of its former size.

The sockeye occurs in most of the coastal streams of British Columbia, and is usually the most abundant species. The principal waters frequented are the Skeena, Rivers Inlet, Nass, Lowe Inlet, Dean Channel, Namu Harbor, Bella Coola, Smith Inlet, Alert Bay and Alberni Canal.

In Alaska, where this fish is generally known as the red salmon, it is abundant and runs in great numbers in all suitable streams, of which, in Southeast Alaska, the following are the most important: Boca de Quadra, Naha, Yes Bay, Thorne Bay, Karta Bay, Nowisky Bay, Peter Johnson, Hessa, Hetta, Hunter Bay, Klawak, Redfish Bay, Stikine, Taku, Chilkoot, Chilkat, Alsek, Seetuck, Ankow, etc.; in Central Alaska, Copper, Knik, Kenai, Sushitna, Afognak, Karluk, Alitak, Chignik; in the Bristol Bay region, the Ugashik, Ugagnk, Naknek, Kvichak, Nushagak and Wood. It is also supposed to occur in the Togiak, Kuskokwim and Yukon Rivers, which debouch into Bering Sea, and probably occurs in the Arctic streams of Alaska. The run in Alaska begins usually in June and extends usually to the middle of August. It begins earlier in Prince William Sound, and sometimes extends into September in Southeast Alaska.

On the Asiatic side the species is known to occur at Bering Island and in all suitable streams south to Japan, where it is found land-locked in Lake Akan, in Northern Hokkaido.

This species is the most abundant from a canning standpoint. Its value, however, varies considerably with the geographical location of the cannery. Under the designation of blueback it was formerly abundant in the Columbia River, but in recent years the pack, except in a couple of years, has been quite small, and has ceased to be a factor in the markets. The common designation for this species in Puget Sound and British Columbia is sockeye, and under this name the pack is marketed at a considerably higher figure than the same species when packed in Alaska and called red salmon. Some canners claim that the Puget Sound and Fraser River sockeye contains more oil than the Alaska red, and while this may be true, it is extremely unlikely that it would be true also with respect to the sockeyes running in the other streams of British Columbia, especially those in the northern portion. By far the greater part of the total pack of this species is made in Alaska.

The flesh is a deep red, and it retains this color when canned, and this, with the comparatively large quantity of oil found in its tissues, makes it specially valuable for this purpose. The bulk of our foreign exports is composed of this species. The packer rarely ever has any difficulty in disposing of his pack of this species at remunerative figures.

Silver or Medium Red Salmon

The silver, silverside, medium red or coho salmon (*O. kisutch*) is silvery in spring, greenish on the upper parts, where there are a few faint black spots. In the fall the males are mostly of a dirty red. The flesh in this species is of excellent flavor, but paler in color than the red salmon, and hence less valued for canning purposes.

This species has a maximum weight of about 30 pounds, with a general average of about 6 pounds.

The silver salmon is found as far south as Monterey Bay, where it appears during the month of July and is taken by the trollers. From Eel River, in California, north, it is found in most of the coastal streams. It usually appears in July and runs as late as November, the time of appearance and disappearance varying somewhat in different sections. Owing to its late appearance comparatively few, and they usually in the early part of the season, are packed by the canneries, most of which shut down in July and

August. This fish also tarries but a short time about the mouth of the stream it is to enter, and is wary of nets, which makes it rather unprofitable to fish for the latter part of the season when it is running alone.

On the Asiatic side the coho ranges down the coast to Japan.

This species, owing to its lighter color when canned, does not command as good a price as *O. nerka*, and is not in as good demand, as a result of which, and for other reasons noted above, the yearly pack is comparatively small.

Humpback or Pink Salmon

The humpback or pink salmon (*O. gorbuscha*), is the smallest of the American species, weighing from 3 to 11 pounds, the average being about 4 pounds. In color it is bluish above, silvery below, the posterior and upper parts with many round black spots, the caudal fin always having a few black spots, oblong in shape. The males in fall are dirty red and are very much distorted in shape, a decided hump appearing on the back, from which deformity the species acquires its name. The flesh is softer than in the other species; it is pale in color, hence its canned name, "pink" salmon.

The southern limit of the fish is the Sacramento River, but only occasional specimens are found here and in the rivers northward until Puget Sound is reached. Here a large run appears every other year, the only place on the coast where such is the case.

The humpback occurs in varying abundance in the waters of British Columbia, but it is in the waters of Southeast Alaska that it appears in its greatest abundance. Many of the canneries in this region depend mainly upon the humpback for their season's pack, and the canned product now occupies an excellent position in the markets of the world. The fish spawn in nearly all of the small, short streams.

In Central and Western Alaska the runs are much smaller and the humpback is not much sought after by the cannery men, who are usually able to fill their cans with the more valuable species.

On the Asiatic side it is found in the rivers of Siberia (abundant in the Amur), but not in Japan.

In Southeast Alaska the run begins in June and continues until September, or even later in some places. In Western Alaska the period is somewhat shorter. In Puget Sound it continues until late in the fall.

This is the second most abundant species from a canning standpoint, and owing to its great abundance it will ultimately attain to first place as the more valuable species are reduced in numbers by excessive fishing.

Dog or Chum Salmon

The dog or chum salmon (*O. keta*) reaches a maximum weight of 16 pounds, the average being about 8 pounds. When it first appears along the coast it is dirty silvery, immaculate or sprinkled with small black specks, the fins dusky, the sides with faint traces of gridiron-like bars. Later in the season the male is brick red or blackish, and its jaws are greatly distorted. Its flesh is quite pale, especially when canned, when also it is mushy in texture. It is especially good for freezing, salting and smoking.

This species has a wide distribution. It is found as far south as San Francisco, but it is not utilized commercially in California except on Eel River. It is found in most of the coastal streams from here north, being especially abundant from Puget Sound northward to Southeast Alaska, both inclusive. In this region it is being utilized in greater numbers each year, as the market for it widens.

In Central, Western and Arctic Alaska, the species occurs in varying abundance, but is utilized sparingly, except by the natives, with whom it is the favorite species dried for winter food.

This is the most abundant species of salmon in Japan, where it is called sake, and large quantities are dry-salted each year. In Siberia the species is abundant and is known as kaita or kita.

The run of dog salmon comes later than that of any other species except the coho. In Alaska it begins in June, but the height of the season does not occur until late in August or early in September, and fish are found as late as November. In Puget Sound they run from about the middle of August until late in November, and practically the same is true in the Columbia River.

The pack of this species varies greatly, depending mainly upon the demand. If the price is remunerative a large pack can be made as the species runs for a longer period than any other.

Handling the Fish

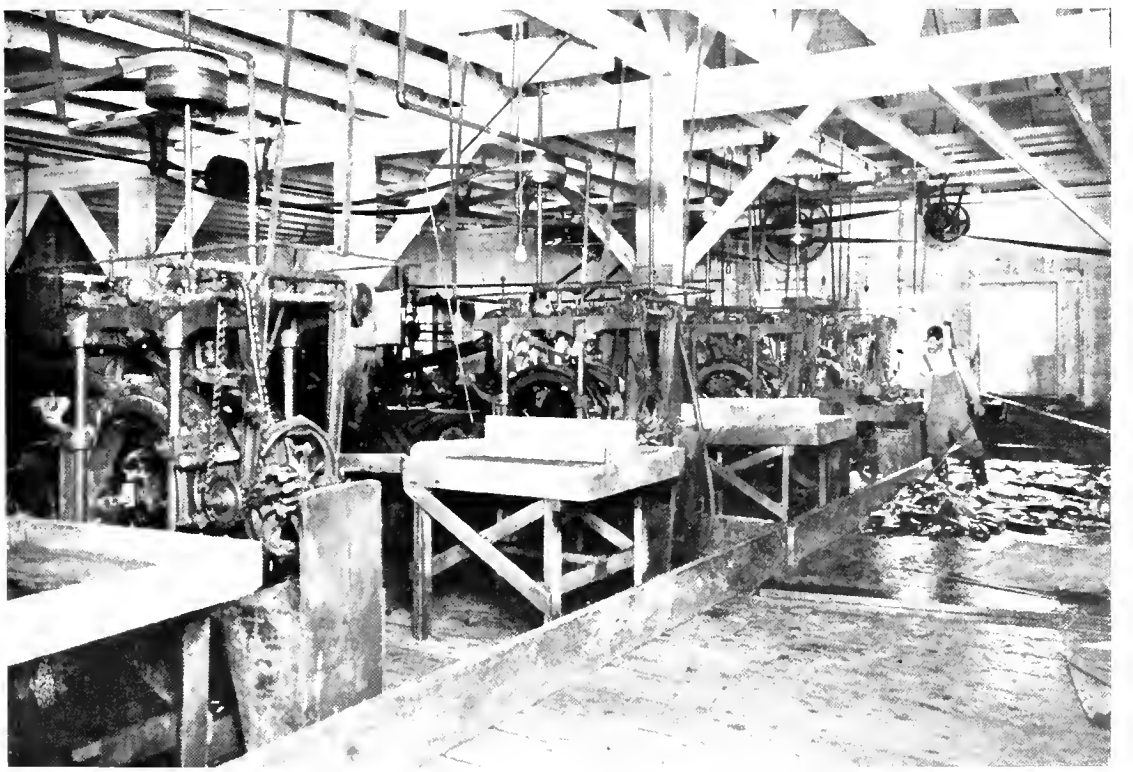
The prime requisite in this business is to so locate the cannery that it will be within convenient distance of the fishing grounds, thus reducing to a minimum the distance the fish have to be transported. This will make possible the packing of an almost absolutely fresh product and will also cut down expenses very materially, as the transportation of the raw product from the fishing grounds to the cannery forms a large item even to the best situated canneries.

At convenient spots near the fishing grounds large scows and lighters are anchored and the fishing crews deliver their catches aboard these, the tallyman on each scow keeping a record and giving the crew a receipt. Men fishing near the cannery deliver their catch alongside. Steamers and launches are used to tow out empty scows and bring in those filled. In the old days the fish were pitched by hand into bins on the wharves, but this laborious method has been superseded by the use of an elevator, which extends from a short distance above the top of the wharf to the water's edge, provision being made for raising or lowering the lower end according to the stage of the tide. This elevator is slanting, and is made of an endless chain operating in a shallow trough. About every two feet there is attached to the chain a crosspiece of wood. At the top of the elevator are chutes which deliver the fish at various convenient spots on the cutting-room floor. Self-unloading scows are also coming into use now, and with these it is not necessary to use a pew in emptying them.

Great care should be used in keeping the cutting-room clean. Most cannerymen, as soon as it has been cleared of a batch of fish, turn the hose upon it and thoroughly wash down the walls and flood the floor, after which the floors are salted, and then it is ready for the next batch. Unfortunately some few cannerymen cannot see the necessity for this thorough and frequent cleansing of this most important part of the cannery proper, and do it at infrequent intervals, with the result that the room soon emits a most unpleasant odor, and the product undoubtedly suffers from this lack of cleanliness.

Salmon are generally used very shortly after reaching the cannery. Most cannerymen agree that it is necessary to allow the fish to lie from ten to twenty-four hours after being taken from the water before being canned, claiming that if some of its moisture has not been allowed to evaporate a pound of meat cannot be packed into the can. While chinook, coho, red and, at times, chum salmon may possibly be kept with safety and profit for twenty-four hours, this can rarely ever be done with the humpback salmon, which soon softens and spoils after being removed from the water. The condition of the weather and

MACHINE FOR CUTTING SALMON INTO LENGTHS TO FIT THE SIZE OF CAN USED.



THE "IRON CHINK," WHICH DRESSES AND SLIMES THE SALMON.

the temperature very materially affect the time salmon may be kept. In Alaska, where the weather is generally moist and the temperature low, fish may be kept much longer than in Washington, Oregon and California, where the weather is usually dry and the temperature high in the summer time, when the canning is done. The danger of canning fish that are too fresh, however, is of minor importance as compared with the tendency in the other direction upon the part of some unscrupulous canners.

Salmon are covered with a natural coat of slime, and this aids very materially in preserving the fish from decay.

Before dressing the fish a stream of water is kept playing over them in order to remove the dirt and slime, after which men with jews separate the different species into piles.

The work of dressing is done by the "Iron Chink," a marvellous piece of mechanism which butchers the salmon at the rate of three thousand per hour. Before the fish enter the machine the head and tail are cut off by band-saws. After it enters the machine no hand touches it until it emerges. It is fed to the machine tail-end first, belly up, and in the course of its journey upwards around the wheel, gang knives first divest it of its fins, a stationary knife, somewhere in the circuit, slits open the belly, and a revolving brush sweeps out the entrails, which drop through a hole in the floor onto conveyors beneath, and thence are transported to the scows. An improved type of this machine will also "slime" the fish, thus materially reducing the amount of labor needed.

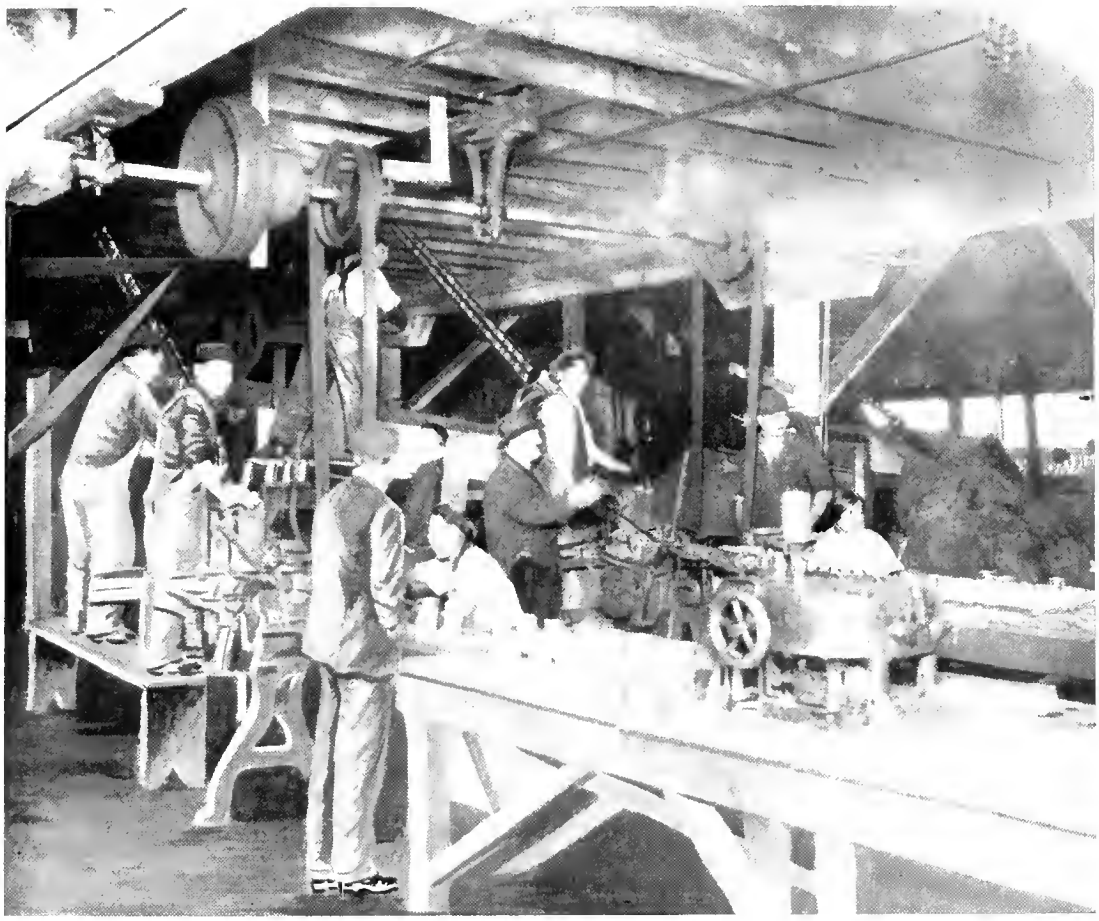
After passing through the "Iron Chink" the fish passes on to a belt elevator, which carries it to a trough of running water, where it is scaled, washed and scraped. It is then passed to another tank of water, where it receives a second washing, scraping and final brushing with a whisklike broom, which removes any offal, blood and scales that were overlooked in the first washing. This is called "sliming," and after it is finished the fish are removed to large bins on either side of the cutting machine. There are now on the market a couple of machines for doing the "sliming."

The usual method of cutting the salmon is by a machine. This is generally a large wooden cylindrical carrier, elliptical in shape, thus having a larger carrying capacity, and with ledges or rests on the outside wide enough to hold the fish, and are slit in cross section through the ledges and outer casing to receive the gang knives. The carrier and gang knives are set in motion, each revolving on its own shaft. As a rest on the carrier comes to a horizontal position, men stationed at the fish bins lay a fish on each ledge as it passes. Thence it is conveyed to the revolving gang knives and, after being divided, passes through on the downward course, sliding off the rest into the filling chute. The knives in these machines are so arranged as to cut the fish transversely in sections the exact length of the cans to be filled.

The rotary cutter shunts the tail pieces to one side, and these are carried by means of a chute to baskets, from which they are later removed and canned separately. As the tail portion is much smaller, with less meat, and proportionately more bone, it can not be placed in the cans with the middle and head sections without detracting from their value.

In some of the smaller canneries, especially in those packing flat cans, the gang knives are worked by hand. In this case the knives are not circular but elongated or semi-circular in shape, tapering at the outer ends. They are mounted on an axle having a large iron lever at one end, and when this lever is raised the ends of the gang knives are thrown up and back. The fish is then placed in position under them and the lever pulled forward, the knives, with a scimitar-like movement, dividing the fish.

FILLING SALMON CANS BY HAND.



THE SALMON FILLING AND WEIGHING MACHINES.

Canning the Fish

Every can of salmon is seasoned with one-fourth of an ounce of salt, which, to insure uniformity, is added by mechanical means. A table is used, in the top of which are holes equal distances apart. On the under side of the top is a sheet-iron plate, with an equal number of holes, which slide in a groove at the sides, and is worked either by a hand or foot lever. Just below is an open space large enough to accommodate a tray holding 36 to 48 cans. A workman stands in front of the table and slides a tray of cans into the open space. He then throws a quantity of salt upon the table and immediately scrapes this off with a thin piece of wood, each hole being filled in the operation, and the salt being prevented from falling through by the iron plate underneath. The lever is then pressed, the iron plate moves forward until the holes in it are directly under the table top, when the salt drops through into the cans. This operation can be repeated four or five times in a minute. Special machines which automatically deposit the required amount of salt in the can just before it enters the filling machine are now in quite general use.

Most canneries now use filling machines, although a few, more particularly those packing flat and odd-sized cans, still fill by hand.

The filling machine consists of a chute with a belt to which are attached wire racks about four inches apart, set at an angle to prevent the salt from spilling out, into which the salted cans are fed from the floor above and pass into the machine. At the same time the divided sections of salmon pass down another chute into the mouth of what looks like a hand coffee mill. They pass through here down a smaller chute and are forced by two dogs into a receptacle through which the plunger, or filler, passes. Here the plunger comes opposite the open mouth of the empty can, which when it reaches this point is caught by a clasp or hook and held in front of the plunger, which is immediately thrust forward through a chamber filled with salmon, cutting the fish longitudinally and at the same time filling the can. The next movement forces the can out upon a table. When running at full speed one of these machines will fill about 80 cans a minute.

On being released by the clamp the cans roll upon a long table and are picked up by a man stationed here, who strikes each one upon a square piece of lead set in the table, in order to settle the contents down into the can and for the purpose of detecting any deficiency in weight. If not quite full the cans are pushed to the other side of the table, where an operator adds the quantity of fish needed, a supply of small pieces being kept at hand for this purpose. Generally the cans overrun in weight, frequently as much as an ounce. Occasionally a can is weighed in order to see that the machine is in perfect adjustment.

Most canneries now use a weighing machine, which forms part of the regular line of machinery. Should the can be of the proper weight it will pass right along, but if short weight it is switched to one side, and is then brought to the required weight by filling up with pieces.

In the hand method the fillers stand or sit on each side of a long table with a trough running down the middle from end to end. This is filled with the cut pieces of salmon, and the fillers, usually women and children, put into the cans the large pieces first and then smaller pieces to occupy the vacant spaces. By this method the fish are so placed in the can that when opened by the consumer later on it presents a much more uniform and inviting appearance than the cans filled by machinery, which necessarily have a somewhat jumbled appearance when opened.

In some canneries the cans are then washed by applying either jets of water or steam to the sides.

Sanitary Method

The sanitary can has now almost entirely superseded the old soldered can. The statement is frequently heard that this type of can is solderless, but such is not really the case. As a matter of fact the long side seam of this type of can is treated with both solder and flux, the latter usually of an acid character, but the can is of such a superior type that it is but rare to find one which will show a trace of either solder or flux on the inside. The tops and bottoms are crimped on without acid or solder by machines called "double seamers," because they fold the flanges of side and end over twice in the crimping process. In order to make sure of an airtight joint the ends are coated with a rubber-like compound. A recent invention is that of a paper gasket to accomplish this purpose.

By the use of sanitary cans the soldering machine, in fact, all use of solder and acid after the cans have been filled, is done away with, while the exhausting in retorts and the subsequent venting and soldering are completely done away with, a considerable saving both in labor and time consumed.

In the sanitary method the cans when they come from the filler pass along an endless belt to the topper and crimper. This machine trues up the upper edge of the can and attaches the top of the can loosely to the body in such a way as to allow the gas generated in the can during the exhausting process to escape gradually, yet prevents the fish from coming in direct contact with the steam of the exhaust box.

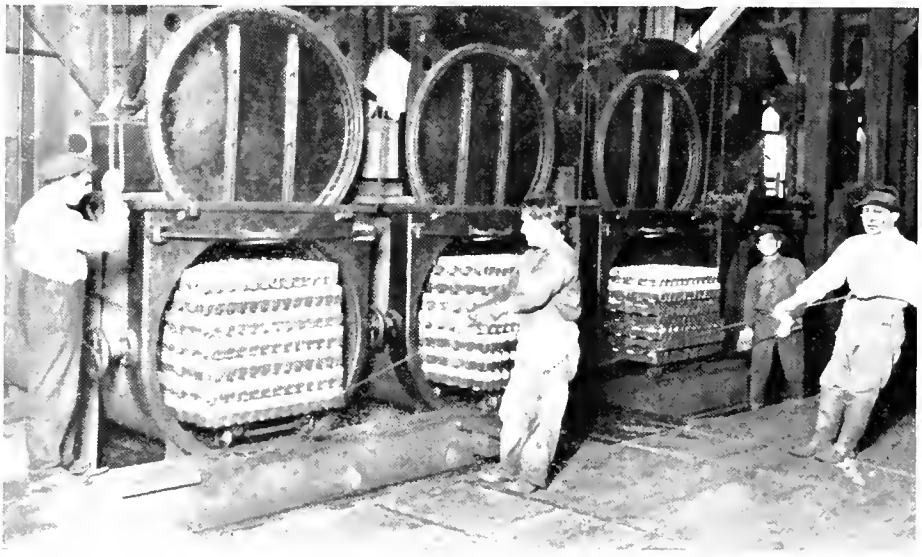
Some of the exhaust boxes used in connection with sanitary cans are about 30 feet long, with the cans traversing the full length seven times, while others are so arranged that they traverse the full length eleven times. Each run is supposed to take about a minute and a half, with a total in the first instance of about 10 minutes for a can to pass entirely through the box, or about 15 minutes with the last named, but there is considerable deviation from this time in various canneries, some shortening the period, while others lengthen it. The heat is usually from 206° to 212° F., 210° appearing to be the safest in most cases. The above holds good mainly in Alaska.

On Puget Sound sockeye 1-pound tall cans are usually exhausted 8 to 10 minutes at a temperature of 210° to 211°, while 1-pound flats are usually exhausted at the same temperature for about 6 minutes, and halves for about 7 minutes. Cohos, pinks and chums are exhausted the same as sockeyes. With ½-pound springs the exhaust is usually for about 7 minutes at 210° to 211°.

Upon leaving the exhaust box the cans pass to the double seamer, which completes the operation of sealing on the tops. Passing from here on the endless belt the cans are run through another washer and then are transferred to the coolers and these are immediately placed upon the trucks and run into the retort for the one cooking they are to undergo. The time they are to remain here varies in the different sections and with the different species and sizes of cans. In Alaska 1-pound tall reds, cohos, chums and pinks are generally cooked from 90 to 120 minutes at 12 to 18 lbs. pressure and a temperature of 242° to 248° F. One-pound flats and half-pound cans are generally cooked about 10 minutes less time. Owing to their larger bones king salmon are generally cooked from 10 to 20 minutes longer than the other species.

On Puget Sound 1-pound tall sockeyes, cohos and pinks are generally cooked for 90 minutes at a pressure of 10 pounds and a temperature of 240° F. Halves and 1-pound flats are generally cooked at the same temperature but for only 80 minutes. Chum talls are generally cooked for 105 minutes at a pressure of 10 pounds and a temperature of 240°, while spring salmon are cooked for 120 minutes at a pressure of 10 pounds and a temperature of 240°.

It is the custom at all canneries, no matter what the system, to allow about five minutes at the beginning of the high temperature cook to work up the required heat of the retort, and when cooking is complete there is a like period for reducing the temperature and pressure before opening the doors. The cooking times given above are exclusive of the two five minute periods noted here.



EMPTYING RETORTS OF THE CARS LOADED WITH COOLERS OF FILLED CANS.

It should be distinctly understood that the processing times noted are only approximate. The condition of the fish, the weather—whether hot or cold, rainy or dry—etc., all have a bearing on the question and must be taken into account. The packer cannot go far astray, however, if he keeps generally within the narrow margins noted above.

Imperfect cans which are repaired before cooking are naturally in the same condition as if there had been no defects. If the leaks are discovered after cooking and are repaired at once and the contents recooked, they are still very good, the only difficulty being that they have lost some weight in the process of repairing the leaks. The above goods usually go in with the regular pack of their kind and are not classed as "do-overs."

When, however, a cannery is running at full capacity, defective cans can not always be repaired and recooked at once and are sometimes set aside for days. Decomposition follows, of course, as with any other meat that is exposed to the air, and the fish becomes unfit for food. When recooked the meat becomes mushy and the blowing or venting makes the cans very light, a defect which is frequently corrected by adding salt water or a soup made by boiling salmon in water. This, the "do-over," is the lowest class of goods, and but few are ever shipped by canners, as the consensus of opinion amongst food officials and cannerymen generally is that they are not a fit article of food.

On coming from the retort the coolers are lowered into a bath of lye, or, as in some canneries, the cans are run through such a bath on an endless belt, which, with the aid of a slight rinsing and a few rubs with a brush over the top, removes from the can all the grease and other materials which have accumulated on it in its passage through the cannery, and then passes into another bath where the lye is washed off in hot fresh water.

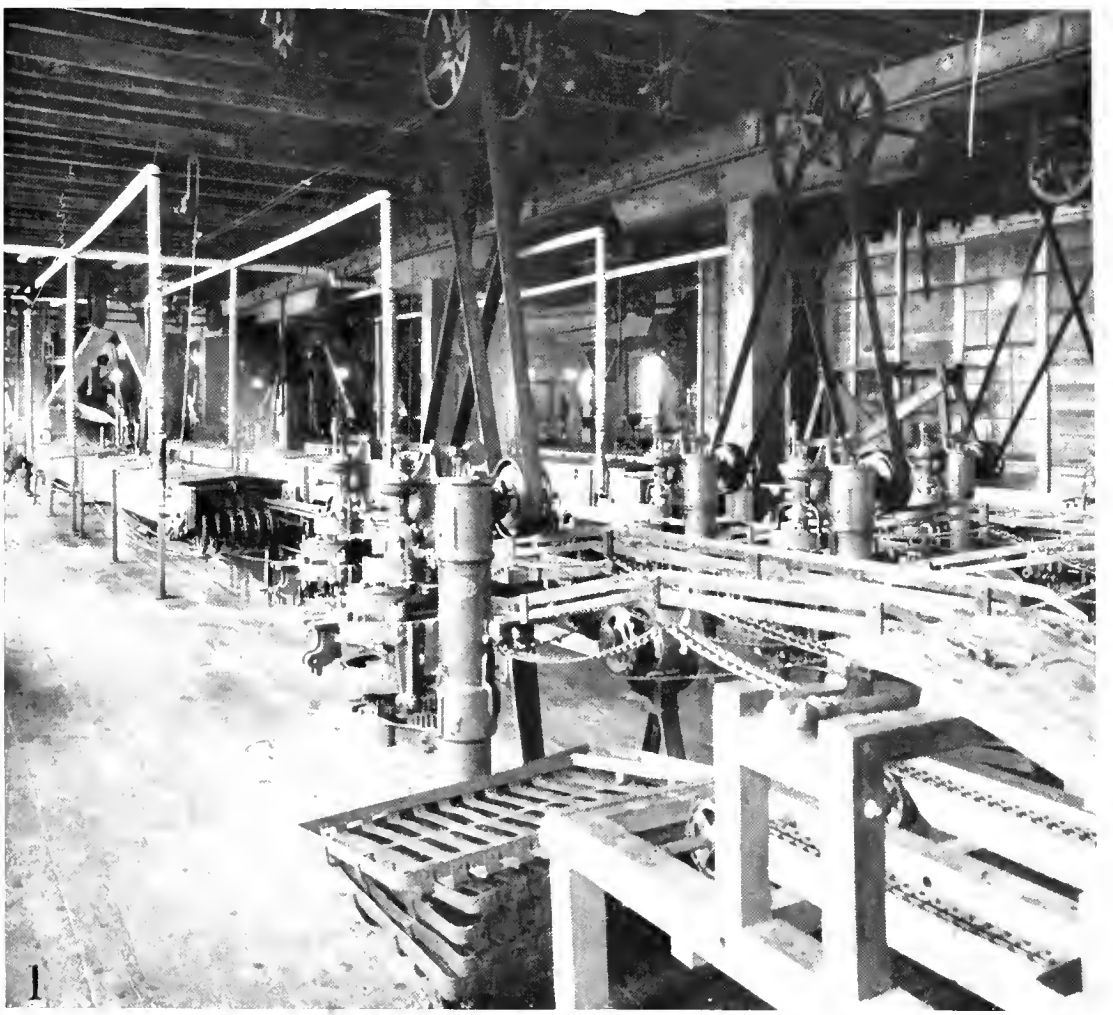
From the lye bath the cans go to the cooling room, where a stream of water is played upon them, or, during rainy weather, are placed out of doors upon the wharf, and there

allowed to cool. This is very necessary, as otherwise the heated contents of the cans would continue to cook for some time after being removed from the retort, and possibly become mushy from overcooking.

The top and bottom of the cans contract in cooling, and for several hours a sharp popping noise is heard. Here, as in nearly every process through which they pass, the cans are again tested, this time by tapping the tops with a small piece of iron about six inches long, or, sometimes, a 12-penny nail. The sound conveys to the trained ear of the tester an unmistakable meaning as to the condition of the can, and the faulty cans that escape notice during the other tests are generally found in this one.

Lacquering

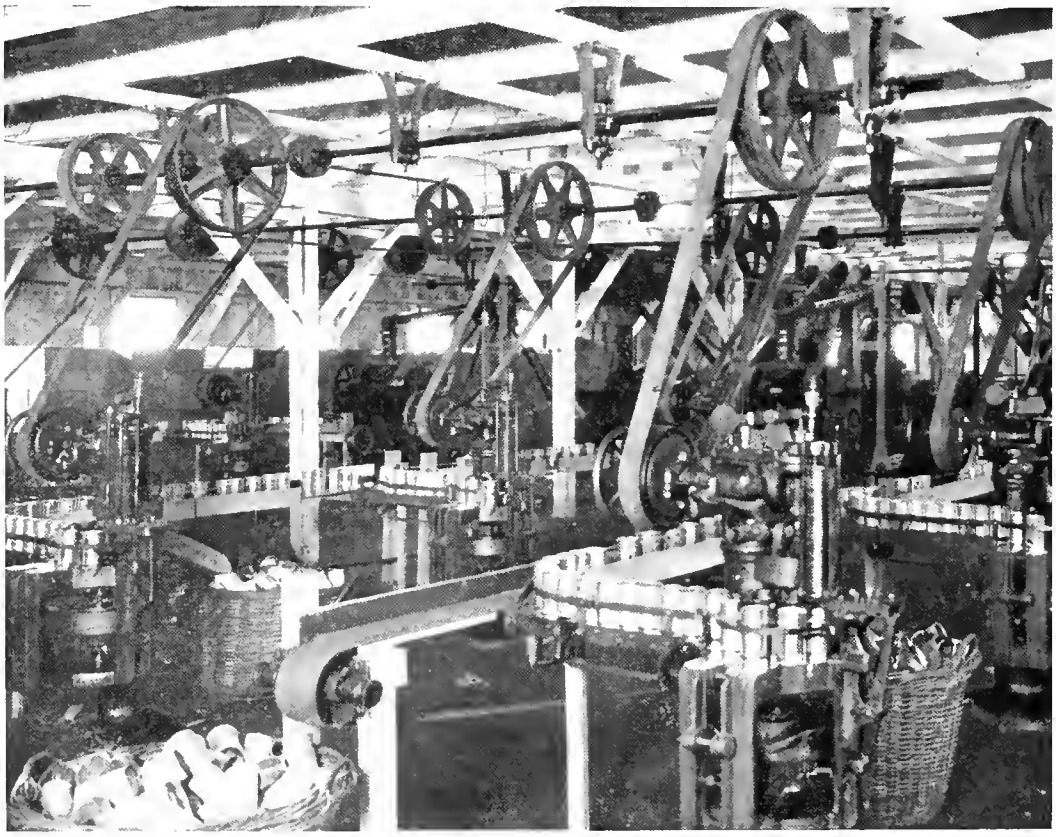
A common and at one time universal custom in the salmon-canning industry, but one that is not common in the canning of vegetables, fruits, etc., is that of lacquering the cans. This idea of protecting the can on the outside has been followed from the very beginning, for two reasons: (1) That the English market which, at that time especially, absorbed the greater part of these goods, insisted on their shipments being finished in this



SALMON CANNING LINE SHOWING EXHAUST BOX, DOUBLE SEAMER, ETC.

way, and (2) from the fact, as the canners then thought, that if they did not protect their cans in some way enormous losses through rust would ensue.

The first experiment of this nature was to paint the cans by hand with red paint, treating each can singly. Next a composition of logwood extract and alcohol was tried, which, however, did not produce satisfactory results for a very plain reason—the can was dyed instead of being lacquered. The next attempt was to varnish the cans with a japan varnish reduced with alcohol, but this was found to dry too slowly for speedy handling. After extended experimentation the quick-drying brown lacquer of the present time was evolved, which carries asphaltum in the form of an asphalt varnish as its base, this being supplanted in some cases by gilsonite. This lacquer can be procured in either a heavy or light body, is generally reduced with benzine or gasoline, and is applied according to the requirements of the market, which in some localities demands a heavy coating and in others a much lighter finish, the latter giving a rich golden-brown color. Some experiments have also been made in using brighter colored lacquers for this work. Several of these, made to give a bright golden, copper or other color, are extremely



MAKING SALMON CANS IN AN ALASKA CANNERY.

attractive in appearance, while at the same time protecting the tin against rust quite as well as the brown.

The industry soon outgrew the hand method of lacquering, and the work is now done almost entirely by special machinery designed for this purpose.

A few of the large packing companies have given up the lacquering of the body of the cans, claiming that the label fully protects this portion of the receptacle. As the

enameled ends are usually bought from the can-making companies, those who follow this practice have been enabled to cut loose altogether from the somewhat dangerous work of lacquering in the cannery.

A few flat and oval cans are not lacquered, but are protected from rust by wrapping in tissue paper, over which the label is placed.

Boxing

A case of salmon generally contains 48 one-pound cans or the equivalent, i.e., 24 two-pound cans or 96 half-pound cans. Some canneries pack their half-pound cans in cases holding 48 cans. The cases are made of wood and are generally bought from the mills cut to the proper lengths for putting together in the cannery.

Can-Making

Along the coast and in parts of Southeast Alaska most of the canners buy their cans ready made, but, owing to the bulk of the empty cans making the freight rates disproportionate to the weight involved, the canners in Western and Central Alaska and parts of Southeast Alaska, have installed can-making machinery at their plants and, in the case of sanitary cans, manufacture the bodies of the cans from sheet tin, the tops and bottoms being purchased from the can-makers on the coast. In the case of the old-style cans not only the bodies, but also the tops and bottoms, are manufactured at the cannery. One can-making company has recently devised a system by which it can collapse the body of the can so that 400 may be packed in the ordinary 48 one-pound tall salmon case. At the cannery the collapsed bodies are run through a simple reshaping machine and the bottoms may then be put on in the same manner as are the tops. An added advantage which the big canners find in making their own cans is that it provides work for a large part of the cannery crew who would otherwise be unemployed while the rest of the force was getting ready the other necessary paraphernalia.

Analyses of Canned Salmon, 1911 Pack

[By U. S. Department of Agriculture]

	Water	Ethyl Ether Extract*	Protein (N x 6.25)	Total ash	NaCl.†	Ammoniacal Nitrogen	
						Richardson method	Alcohol Vapor method
No. 1—							
Puget Sound Sockeye Salmon	62.44	15.17	20.25	2.50	0.79	0.0403	0.0348
No. 2—							
Puget Sound Sockeye Salmon	61.84	13.74	21.77	2.73	1.10	0.0437	0.0410
No. 3—							
Alaska Medium Red Salmon	69.97	7.81	20.40	2.58	1.09	0.04965	.....
No. 4—							
Alaska Chum Salmon	73.48	2.88	21.33	2.57	0.83	0.0563	0.0557
No. 5—							
Alaska Pink or Humpback Salmon	74.12	4.75	19.75	1.98	0.50	.0404	.....
No. 6—							
Alaska Red Salmon	70.88	5.26	21.79	2.35	0.64	.0155	.....

Each sample was average of two or more cans.

All samples, except No. 2, were old form 1 lb. tall cans.

No. 2 was ½-lb. flat cans.

*Represents the fat.

†Represents the salt.

Canned Smoked Salmon

Smoked salmon is one of the choicest of fishery products, and while the greater part so prepared is sold in bulk, a constantly increasing quantity is being packed in cans and jars, in which condition it will keep indefinitely, an impossibility when not so packed.

While a few canners use hard-salted, mild cured or frozen fish for smoking previous to canning, most of them prepare fresh salmon for this purpose, so the methods followed in the curing and thawing of the former will not be described here.

When handling fresh fish, after dressing (they are usually split down the back in this operation) they are placed in a pickle of 90° (salometer) and allowed to soak here for about 8 to 12 hours, depending upon the size of the fish; small fish require less time than large fish. When hard-salted or mild-cured fish are used, the greater part of the saltiness must first be removed, while in the case of frozen salmon the fish are thawed out either by immersing them in water over night or by laying them on boards in a moderate temperature and turning them over every 2 or 3 hours for 8 or 10 hours, when they are sufficiently thawed for handling, after which they are pickled the same as fresh fish.

After they are sufficiently soaked the flesh is smoothed with the side of a flat knife, all ragged parts being pressed down. Each fish is then trussed wide open and arranged with cords or iron or wire hooks so they can be hung up on the cross sticks in the smokehouse.

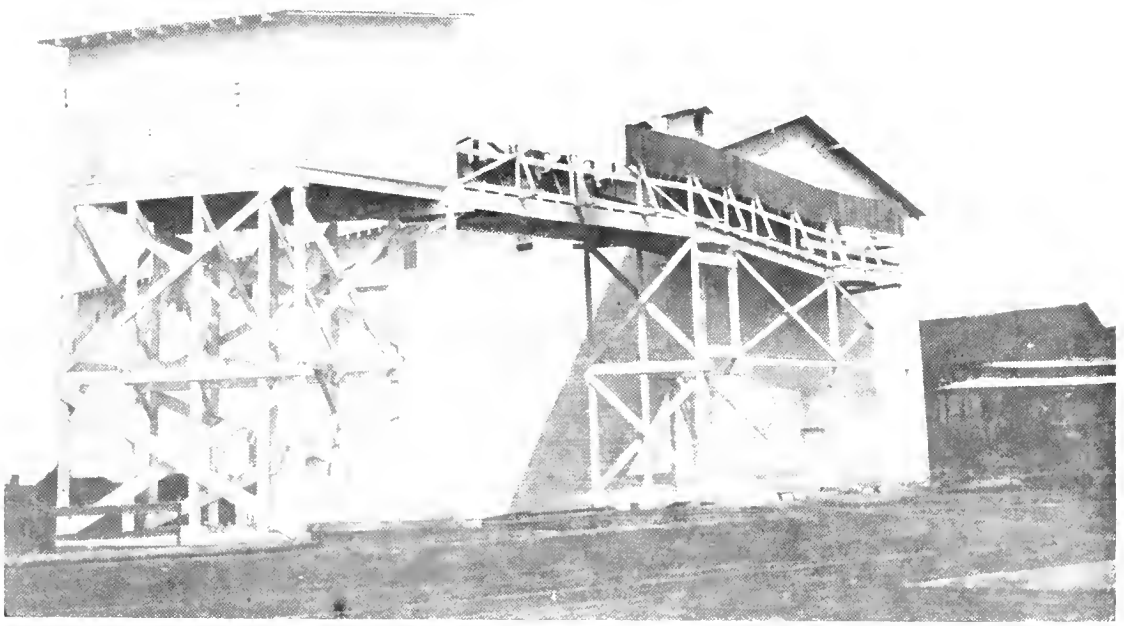
After draining for several hours, they are hung in the upper part of the smokehouse, away from the heat, but not so high as to be in the warm air which accumulates at the top of the bay. Usually only two rows or tiers are smoked at a time, and in the lofty smokehouses the smoking is continued for 18 to 36 hours. About 24 hours are usually required, but on dry, windy days 16 to 18 hours are sufficient, and during sultry weather 30 or more are necessary. When low smokehouses are used, in which the fish are hung within 8 or 10 feet of the fire, the smoking is usually completed in about 12 hours. The smoke should be even throughout and with little fire. In some houses a light fire is built under the fish as soon as placed in the smokehouse, and this continued for 6 or 7 hours, when a shovelful of sawdust is added and the smoking continued for 12 or 14 hours. Fish so prepared will keep for 10 days or longer under favorable conditions.

Some salmon are kippered before being canned. In this event the fish are generally cut in cross sections after salting, and these pieces placed on wirework screens, which are slipped into racks with grooved compartments for receiving and holding them. These racks are mounted on rollers and as soon as filled are run into the bays, the work being carried on on the upper floor of the smokehouse. Some smoke the fish whole. Here they are dried in the heat from a hot fire for about 20 hours; the fire is then somewhat smothered with hardwood sawdust and the fish smoked for about 24 hours. Small fish require less time for smoking than large.

One canner prepares his product by curing the fish for 8 hours in brine testing 90°, or sufficiently strong to float a potato. After smoking for 12 hours the fish are cut in pieces to fit the cans. The tops are then put on loosely, the cans run through the exhaust box for 10 minutes at 212° F., the tops sealed, and the cans processed for 90 minutes at 245° F.

It is a comparatively easy matter to pack hard-smoked or kippered salmon in cans or jars. Some cut the smoked fish in pieces to fit the cans, as is done when packing fresh salmon, while others smoke them after cutting, and after placing these in the cans proceed as with fresh salmon. If the fish are hot when placed in the can it will not be necessary to exhaust them, but if put in cold they should be exhausted for about 15 to

SLICED SMOKED SALMON IN FLAT CAN.



A PACIFIC COAST SALMON SMOKEHOUSE.

17 minutes at 212° F., and then processed, 1-pounds for about 45 minutes at about 242° F.

One canner, in 1913, put up some hard-smoked salmon in glass jars without exhausting or processing, and in 1919 these were still in good condition.

Several companies at varying periods have taken up the packing of sliced smoked salmon in cans. One which operated in Seattle several years ago smoked mild-cured salmon until it reached the condition known in the trade as "hard smoked," cohos and kings being employed. The salmon was then cut transversely of the body into very thin slices, averaging 40 to 50 slices to the pound. These strips were then packed flat in cans shaped like sardine cans, a little salad oil added and then sealed up the same as sardines. The cans were then exhausted the same as salmon and processed for about 90 minutes at 240° F.

Salmon in Spices

The salmon are dressed, cleaned and cut into pieces of a size to fit the cans in which they are to be packed, after which they are washed off in clean water. They are then put in a tub or tank and covered with a 60° (salometer) brine and allowed to soak about 1½ hours, or until all the blood has been extracted.

The spiced pickle can be made in the quantity desired by making in the proportion of one quart of cider vinegar, one-half ounce of celery seed, one-third ounce dried mint, one-third ounce dried parsley, one garlic, three small onions sliced, three whole cloves, a teaspoonful of whole pepper-corns, and one-half teaspoonful of salt. Put into pot and bring to a boiling point; then pour the mixture over the salmon and allow it to stand for 24 hours. If the vinegar is very strong reduce with water.

Should the above combination of spices not suit it can easily be changed by the substitution or adding of other spices.

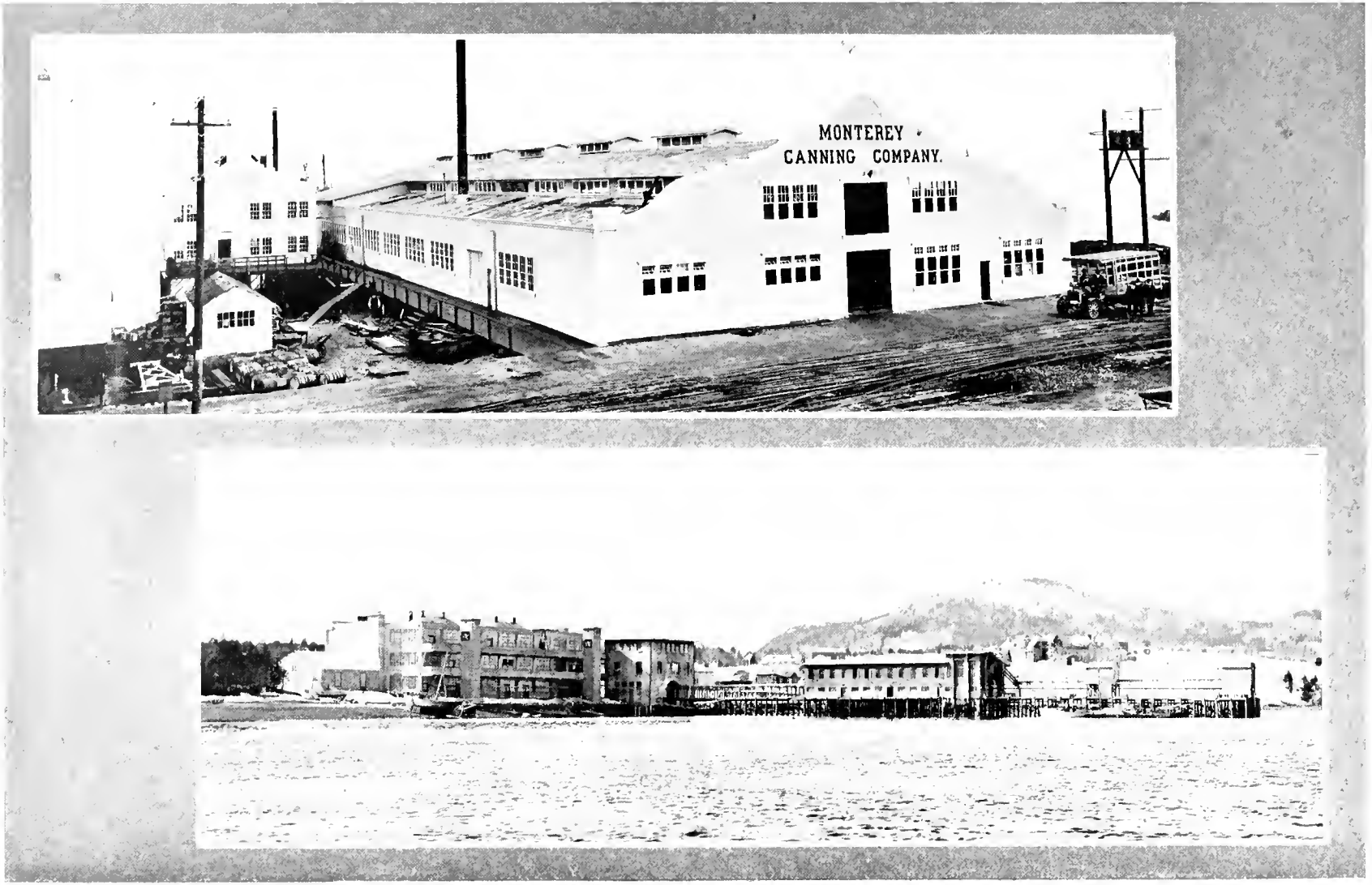
The fish should be put into cans, some of the mixture added, and the cans exhausted and processed the same as with canned fresh salmon.

SARDINES

The second great fish-canning industry of this country is that for sardines. This industry is centered almost wholly in Maine and California. In the former state the industry is a comparatively old one, having been started in 1875. In California it is comparatively new, having been begun early in the century, although it is only since about 1916 that it has attained to any considerable dimensions. In Maine the industry is centered in the eastern part, while in California packing is carried on mainly at Monterey and in southern California.

On the Maine coast the species used in packing is the young of the sea herring (*Clupea harengus*), and in Alaska and on Puget Sound the young of a closely related species, *C. pallasii*. A description of the methods of the fishery, etc., for these species will be found under the heading of "Herring" elsewhere in this volume.

In California the species used is the California sardine (*Clupea caerulea*). The latter occurs in great abundance along the entire west coast and southward on the coast of lower California. It is taken the year round and is especially abundant from September to December. It spawns in the spring. It is an oily, delicately-flavored fish that resembles very closely the European sardine (*Clupea pilchardus*), and when packed in the same manner as in France and with as good condiments, will compare most favorably with them. Although the European species grows to be nearly as large as ours, only



MODERN SARDINE CANNING PLANTS.

Upper, Monterey Canning Co., Monterey, Cal., and Lower, Booth Fisheries Company of Canada, Ltd., Chamcook, Canada.

the small-sized fish are canned there. On our coast fishes of all sizes are canned. The fishery is prosecuted with haul and purse seines.

With the exception of in southern California but little sardine canning has been prosecuted on the Pacific coast, although there are abundant supplies of raw material available in a number of sections. Several modest attempts at sardine canning have been inaugurated on Puget Sound, but for various reasons other than a lack of raw material they all came to naught. Under the conditions which have prevailed during the last few months it is quite certain that properly located plants would prove successful if operated on business principles.

In Alaska, and particularly in the southeast section, young herring, suitable for canning as sardines, are exceedingly abundant, and as the demand for this product increases canneries will eventually be established here. In 1905 a small plant was established in Juneau, where an excellent grade of sardines was put up. The difficulty experienced at that time in securing sufficient labor, and the necessity for competing with the then low-priced Maine product, proved too much and the infant industry soon suspended operations.

Young herring and pilchards are also abundant along the British Columbia coast, and this section will some day be as abundantly dotted with sardine canneries as it is at present with those for salmon.

On the Maine coast sardines are packed wholly in the flat oblong ¼, ½ and ¾-pound cans so familiar to the trade.

In California canning began about fifteen years ago. For some years the fish were packed mainly in 1-pound oval cans, only an occasional pack of the cans typical of the Maine product being put up. In the fall of 1916 the tuna canners, attracted by the high prices then prevailing for sardines, began the packing of the fish in the round flat cans used for tuna. The consumers did not enthuse over this, to them, unusual shape of can, so the packers speedily installed machinery for packing the flat cans so familiar to the trade, with the result that in 1918 the pack amounted to 1,356,648 cases.

The legal season in which weirs can operate in Maine is from April 15 to December 15, but it is seldom that fishing begins as early as the legal season allows. The Maine canneries do not open before May 1, and many of them not before August, consequently there is not much demand for fish until May or June. In California the canneries usually begin on sardines in July. On both coasts the best fishing is said to occur from about the first of August to the end of November.

While sardine canneries are scattered all along the Maine coast, they are most abundant on Passamaquoddy Bay, as they are thus enabled to draw abundant supplies of raw material from not only the American weirs, but also from the adjacent Canadian weirs. The canneries have collecting boats which visit the weirs regularly and buy the sardine-herring, the rest of the catch, which is too large for canning, being sold to the smokers or salters by the owners of the weirs.

On the Pacific coast the fish are usually captured so near the canneries that the fishermen bring them in in their fishing boats.

Amongst the Maine and California sardine canneries are to be found some of the largest and finest fish-packing plants in the country. The buildings, which are located on wharves, for convenience in receiving the fish, are usually two story frame buildings. The interior is partitioned into separate rooms for convenience in performing the various kinds of work necessary. On the first, or lower, floor is the cutting, salting and testing rooms, and storerooms. The second floor has the sealing, packing, drying

INTERIOR OF PACIFIC COAST SARDINE CANNERY.

INTERIOR OF CANADIAN CANNERY PACKING SARDINES AND OTHER FISHERY PRODUCTS.

and cooling rooms, and a storeroom for cans. The attic is used for sawdust and as a general storeroom. The oil and mustard tanks are also located here, and their contents conveyed to the packing rooms by means of pipes. There are usually several smaller buildings for housing the office, the power plant and the box plant, while others have special warehouses for storing the finished product.

In Maine a majority of the employees are residents of the towns and villages in which the canneries are located. There is also a considerable number who come in from the country and the Canadian islands in the vicinity of Eastport and Lubec to work in the canneries during the summer and return home again at the close of the season. Each cannery employs from 50 to upwards of 250 persons, the average being about 140. The employees in every instance comprise both men and women, and a large percentage of boys and girls. The work is usually done by the piece, but clerks, foremen and general laborers are paid by the day or week.

On the Pacific coast the canneries are located within the limits of good-sized cities, from which are easily drawn the labor needed.

The packers and flakers are all women and girls, while the fish-cutters are mostly women and boys and girls. The latter go from one factory to another in the same town, as fish are received at one or the other, and are thus enabled to secure more continuous employment than the others.

On both coasts the food of the herring consists of small animal organisms, chiefly of two small crustaceans, viz.: copepods, or "red feed," and Schizopod crustaceans, or the "shrimp" of the fishermen. When the herring is taken from the water their stomachs are sometimes filled with undigested food and are known as "feedy" when in this condition. The "red feed" noted above rapidly decomposes after the fish dies, even within two or three hours, and this results in the breaking open of the belly of the fish, making an unsightly and practically unsalable product.

There are only two known ways in which this handicap may be overcome. On the Maine coast the fish are usually left alive in the weirs until they have digested this food, when they can be handled without any resulting damage. On the Pacific coast the best method is to anchor a large, square net in close proximity to the fishing ground and turn the catch alive into this until the food has been digested.

The other method is to cut and eviscerate the fish as speedily as possible after being landed, but owing to the scarcity of suitable labor for this work it has usually been impossible to follow it.

In Maine, when the fish arrive at the cannery they are hoisted by power winches from the collecting boat to the wharf in baskets. The baskets are carried into the cutting room usually by being attached to hooks suspended from an overhead track which passes close to the ends of the cutting tables. A few canneries transport them on cars which run on tracks on the floors, or on wheelbarrows. As the fish are brought in they are turned out and distributed along the middle of the tables, so as to be within easy reach of the cutters, who stand on either side at convenient distances apart. The fish-cuting consists in removing the heads and viscera, the work being done with great rapidity. The cutter takes several fish in the left hand at once and, with a special make of shears, or a sharp knife, in the right, cuts off the heads one at a time. (Machinery to perform the above work has been employed to some extent, but with unsatisfactory results, due principally to the varied sizes of the fish used.) Sometimes even the bones are taken out when a certain grade of fish is to be packed. A sweep of the shears or knife removes the viscera and throws the "cuttings" into a barrel at the cutter's side. The fish are thrown by a movement of the left hand into the cutting box, which is located under the

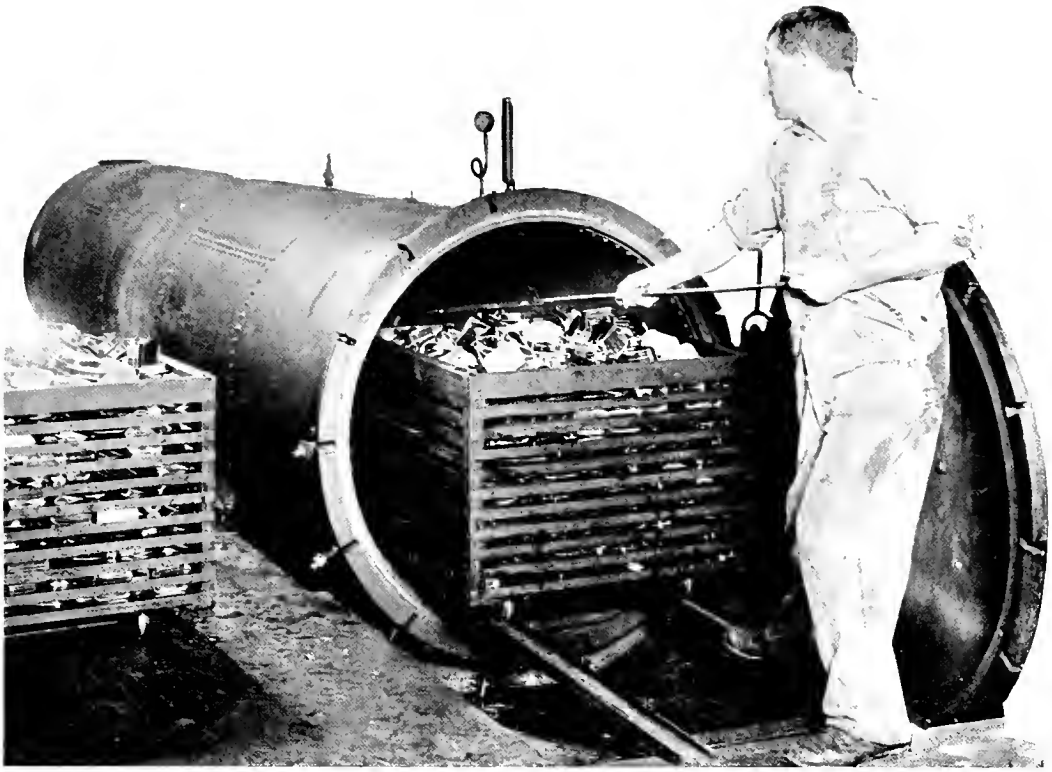
FRYING THE SARDINES.

FISH-CUTTING ROOM

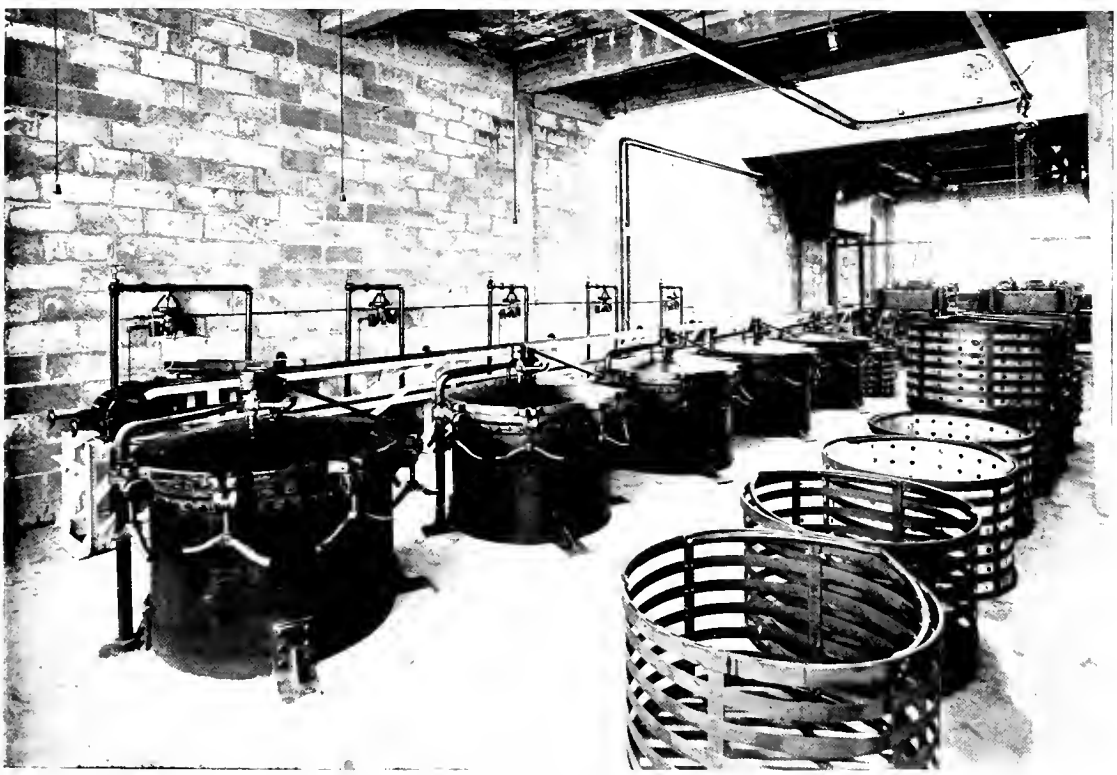
edge of the table. The cutting boxes are each considered to hold fish enough to pack one case of sardines, and it is generally estimated that if the herring are of suitable size and in good condition, so there will be no waste except "cuttings," one hogshead (supposed to hold one thousand pounds of fish, although it really holds about eleven hundred pounds) will pack from 20 to 22 cases, and possibly a larger number. The cutters are attended by a man who removes the boxes (giving the cutter a check for each) and rolls aside the barrels when filled, putting empty ones in their places, so the work may continue without interruption.

As soon as the fish have been cut they are taken to the salting-room and put into a washing-tank, where a man stands with an ordinary scoop net and washes them by rousing them up and down. The water in the washing-tank is being constantly renewed by means of a hose, the surplus water passing out through an escape pipe. The fish are then dipped out into the pickling tanks. The tanks are sometimes hogsheads cut off just above the bilge, but usually they are built of planks and are about 3 feet wide and 2½ feet deep, being generally about 15 feet long and divided into two or three sections. They are filled with strong pickle, made by dissolving one bushel of salt in every 30 gallons of water, or, as it is figured at some canneries, using 12 buckets of salt to 50 bushels of herring. They are allowed to remain here from twenty minutes to an hour, the length of time depending somewhat upon the fatness of the fish and the condition of the weather. If the fish are very fat or the weather is cold it requires a longer time, but ordinarily not more than from 30 to 40 minutes. After being sufficiently "struck" in the pickle they are dipped out into baskets and allowed to drain, after which they are sent up to the flaking-room. The flakers take the fish from the baskets and lay them on the flakes in

PUTTING SAUCE IN CANS FOR TOMATO PACK.



COOKING PACIFIC COAST SARDINES IN HORIZONTAL RETORT.



CRATES FOR HOLDING THE CANS AND PERPENDICULAR RETORTS IN WHICH THEY ARE COMMONLY COOKED.

rows. The flakes are frames about 3 feet long and 22 inches wide, and are filled in with galvanized wire an inch or more apart. Each flake contains five rows of from 18 to 25 fish each, or from 90 to 125 to the flake, according to the size of the fish, and about 10 flakes are required to pack a case of sardines. The flaking is now done by machinery in certain plants.

As soon as a flake is filled it is placed in a movable rack which runs on rollers. These racks hold a number of flakes and as soon as one is filled it is run into a horizontal retort, the door closed and bolted tightly, when the fish are steamed in a live steam bath for 10 or 15 minutes, according to the size of the fish. They are then taken into the drying-room where they are dried by means of a current of dry warm air being forced over and around them for two hours by means of a blower. At a few canneries the drying, when the weather permits, is done by placing the flakes in the open air.

The above method supersedes at many plants the one formerly in vogue of cooking the fish by placing them in wire baskets and submerging them in an oblong tank filled with boiling cottonseed oil (at a temperature of 240° F.) for 30 minutes, and then drying them before placing in the cans.

The fish are then packed in the cans and the latter submerged in boiling oil, heated to a temperature of 240° F., for four minutes, after which the required condiments are placed in the cans and they are then sealed up.

The sardines are packed in cottonseed, olive or peanut oil, mustard sauce, tomato sauce or vinegar with spices. The spices employed are usually mustard seed, allspice, cloves and bay leaves. The mustard sauce is composed of mustard, cayenne pepper, tumeric and other spices. Vinegar is also used for diluting the mustard sauce. The tomato sauce may be prepared by boiling two hours in an enameled kettle: Tomatoes, 100 pounds; salt, 18 ounces; bay leaves, ½ ounce; cloves, ½ ounce; onions, 3 pounds. The preparation is then passed through a fine sieve. The above sauce can be made some time in advance and when needed can be made ready by boiling it again and adding one ounce of butter per pound of sauce.

Under the regulations now in force, prescribed by Maine law, not less than one gallon of the condiment should be used to each case of sardines. The prescribed quantities are one-hundredth part of a gallon for quarter and one-fiftieth of a gallon for three-quarter cans.

The bath tank is generally separated into two compartments, which are filled with water and heated by steam. The steam is conveyed from the boiler of the engine by iron pipes, which pass around the inside of the tank in a number of coils. The pipe in the tank is perforated, so that the steam may come in contact with the water. Each compartment of the tank is fitted with six coolers or large wire baskets. The cans are placed in the coolers and lowered into the tank, where they are completely submerged in boiling water which is heated to a temperature of 212° F. The quarter oil cans are allowed to remain in the bath two hours, and three-quarter mustard, or other large cans, two and one-half hours. They are then hoisted out and the bottoms of the coolers, which are arranged to slide out, are removed, and the cans are released at the head of a chute or screen in the floor which leads down into the testing room. They are first cooled and dried in sawdust, and then shoved down the chute by means of a wooden scraper.

In the testing-room every can is carefully gone over and if a swell is found it is sent to the leak-menders. The final testing for leaks is made by bringing two tins in sharp contact with each other, the absence of oil in the tins being detected solely by sound. The leaks are carefully mended, after which the can has to be vented and refilled with new mixture. A puncture is usually made on the bottom of the can at one end near the

SHOWING MANNER OF PACKING SARDINES IN QUARTER OILS.

edge. The cover and bottom are then pressed back into their proper concave shape and another puncture is made in a similar place at the opposite end, after which the can is stood endwise in a pan of oil, or other condiment, until it is refilled. The punctures are then closed with solder and the can is again put through the bath.

The perfect cans are rubbed clean with sawdust and are then ready to be packed in cases for shipment. In each case there are 100 cans of the quarter or half sizes, or 50 cans of the three-quarter size. The latter, when packed in vinegar and spices, are called "marinees."

A few sardines are also smoked and after cooling are packed in cans, the cans then filled with oil mechanically and passed through the sealing machine. They are then processed by heating for one and one-half to two hours. The cans are usually cleaned while hot and after cooling are tested and are then ready for casing.

Sardines are packed in ¼s, ½s and ¾s on the Maine coast, while on the California coast the same sizes and in addition 1-pound ovals are packed. Most of the small-sized cans have the lettering put directly on the tin before it is made into the can, after which it is lacquered and then made into the can shape. A few of these sizes are left plain and enclosed in cartons, while others are left plain, wrapped in tissue paper and the label then pasted over this. The 1-pound ovals are not lacquered, but have a lithograped label pasted around them. A considerable number of the cans are now equipped so they can be opened with keys.

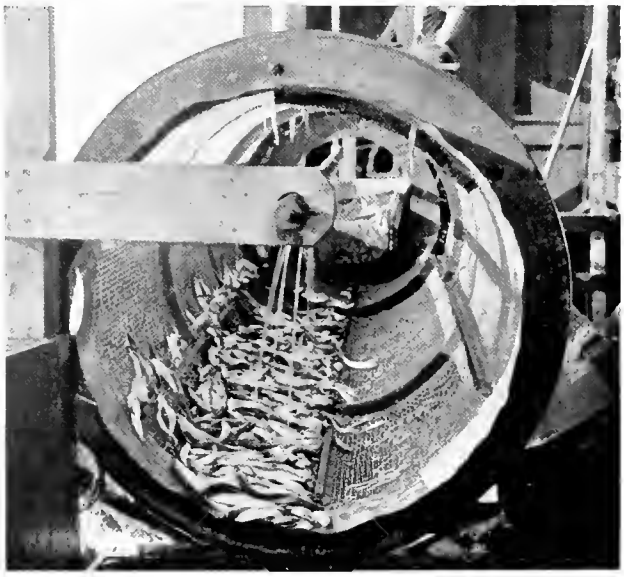
Composition of Maine Sardines

According to H. M. Loomis, director of sardine inspection, National Canners' Association, the average composition of Maine sardines is as follows:

	Plain sardines in oil.	Fried sardines in oil.
Water-free substance	47.9	51.0
Oil	25.5	28.1
Protein	19.2	19.3
Salt	1.5	1.5
Total mineral matter	3.8	4.0

Canning on Pacific Coast

On the Pacific coast for some years large sardines (put up in 1-pound oval cans) were usually the only ones packed, and these were prepared at Monterey. These fish are caught generally at night and delivered at the cannery in the morning. Immediately upon



MACHINE FOR WASHING AND SCALING THE SARDINES.

arrival the fish are put into bins and kept wet with running water for some hours. Some canners use them immediately upon arrival. They are then fed into a revolving drum made of wire, which removes the scales, and from here they pass down a chute into the water tanks, where they are washed.

SCALING AND DRESSING THE SARDINES.

They are then dipped onto tables where operators head them and remove the entrails. They are then washed by machinery and put in pickle tanks, where they are left from 30 minutes to an hour, according to the size and condition of the fish.

As soon as "struck" the fish are removed with dip nets and placed on wire flakes to dry. In order to expedite this part of the work the flakes are placed on a long galvanized wire screen belt that passes slowly back and forth in a mechanical dryer at a temperature of 90° to 100° for about 30 minutes so that all surface moisture will be removed. At some plants a part of the pack is dried by placing the flakes on racks in the open air and depending upon nature to do the work. While this latter method is slower, it is

CLEANING THE SARDINES.

probable that a better grade of fish is obtained. If the fish are not properly dried before they are cooked the results are not satisfactory.

AUTOMATIC BRINE-WASHING MACHINE.

TRAYS ENTERING DRYER AFTER FLAKING IN SUN.

FLAKING TRAYS ON CONVEYOR.

The flakes are then placed on an endless chain which carries them through a long, narrow vat. At the bottom of this vat is a steam coil. When ready for operation the

SPREADING THE SARDINES ON FLAKING TRAYS.

vat is partially filled with water, and then enough oil added to fill it nearly to the top. The oil being lighter than the water will remain on top. Olive oil was used exclusively for some years, but recently cottonseed oil and peanut oil have taken its place. Steam

FLAKING SARDINES IN THE SUN.

being turned on, the water and oil soon attain sufficient heat for cooking, about 240° F., when the flakes are started through. The flakes with large fish require about 12 minutes to pass through. The tail gets brittle when the fish are sufficiently cooked.

DRYING SARDINES BY ARTIFICIAL HEAT.

SEALING SARDINES IN QUARTER-OIL CANS.

The flakes are then transferred to trucks and allowed to remain here to drain and cool for several hours. They are then dumped onto the packing tables, where the fish are packed into the cans by hand and oil or sauce added to fill the interstices. After capping they go through an exhaust box for 8 minutes at a temperature of 212° F., then to the retort, where they are cooked for about one hour and 15 minutes at a temperature of 240° F. From here the cans go through a lye bath in which the outsides are cleaned, and then to the cooling platform until cool enough to be packed in the cases.

PACKING SARDINES IN OVAL CANS.

In southern California, where smaller fish are packed, the fish are generally dried in the sun from one to two hours, artificial dryers being utilized only in emergencies. When packed in regular cans they are cooked in the same manner as the larger ones, but only for from 4½ to 5 minutes, owing to their smaller size, after which they are allowed to cool from 6 to 12 hours. After being put into the cans with the required condiments they are exhausted in the exhaust box, capped, and then processed in retort from 1½ to 2½ hours at a temperature of 220° to 240° F.; the lower the temperature the longer the processing time.

Cottonseed and peanut oils are the ones generally used in the cans. "Soused" is a mixture of small peppers, cloves, allspice and mustard seed mixed with vinegar.

Sometimes the fish are put up in round cans, the same as used for tuna. In this event the fish are cut to fit the can, packed in raw, exhausted, and then processed in a regular steam retort.

It would undoubtedly pay our canners to pack a part of their product in the same manner as the Norwegians, as they have built up a considerable trade in this country with these fish. After being brined the fish "are placed in long rows of little grooves in which a wire rod is run through the eye of each fish. Each rod, with 22 fish on it, is then hung on a flat frame, 30 rods to each frame, making 660 fish on a frame. Ten of these frames are then placed one above the other, with the 6,600 fish hanging from them, in a crate or larger frame. This is wheeled into one of the many smoking ovens, where the fish are smoked for 30 minutes or so, the length of time depending upon the condition

of the fish. They should be lightly smoked and cooked, but not enough to brown them, as the fine silvery finish must be retained for canning.

"The fish are then taken from the smoking ovens to the cutting machine, where their heads are cut off by a machine. The fish are then sorted by hand ready for packing in the cans in uniform sizes. . . ."*

Starch in Tomato Sauce Used in Packing Sardines

The U. S. Bureau of Chemistry in 1918 made the following ruling in reference to the use of starch in tomato sauce used in packing sardines: "Dr. C. L. Alsberg, Chief, in a letter states that a large number of packers of food products who use tomato sauce have been interviewed and their opinion requested on the propriety of the use of starch in the preparation of this sauce. By far the greater number of these packers are of the opinion that starch is not a proper ingredient of tomato sauce and its use is simply that of a substitute or cheapener. This view is concurred in by the Bureau and in the enforcement of the Food and Drugs Act the presence of starch in tomato sauce used in the packing of sardines will be considered as an adulteration."

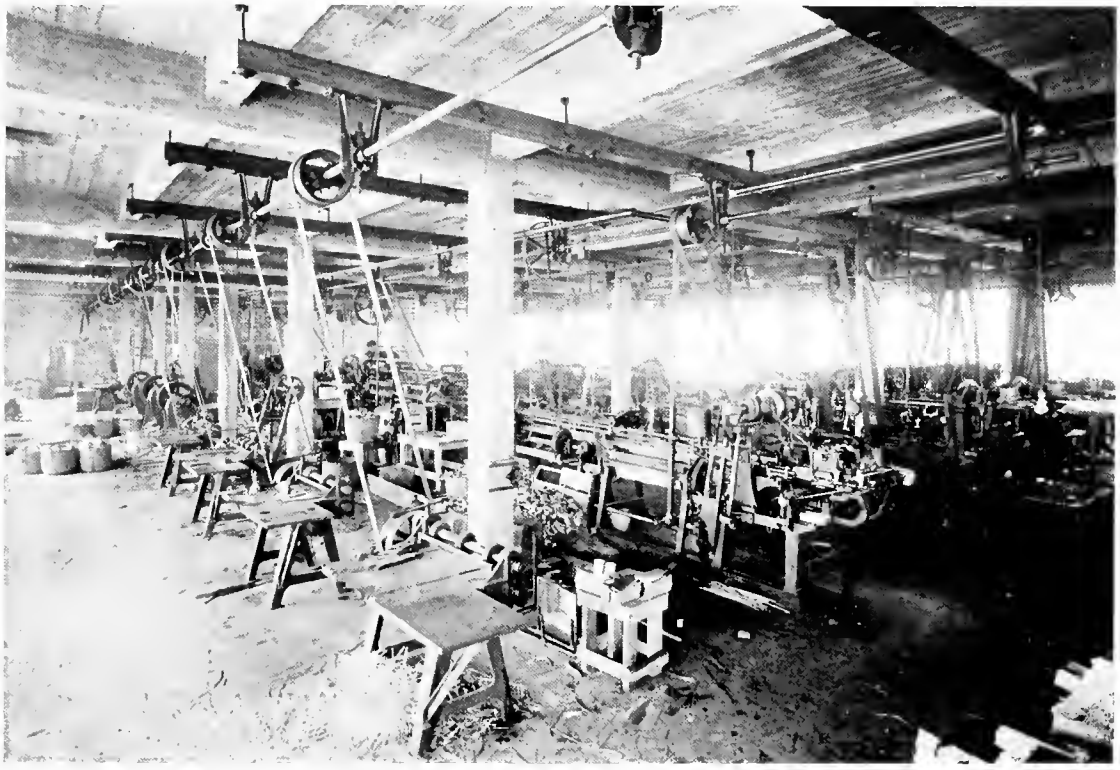
Labeling Sardines

The U. S. Bureau of Chemistry in construing the provisions of Food Inspection Decision 64 is of the opinion that "whenever the name 'sardine' is applied to a fish of the clupeoid family, caught upon or near the shores of, and packed in the United States, it should be qualified by the word 'American' or 'Maine,' or some similar appelation. The Bureau does not consider the designation 'native' to be sufficiently informative as to the country or state in which the fish are taken and prepared. If the expression 'native sardines' is used, it should also be accompanied by the information concerning the country or state as indicated in the Food Inspection Decision 64."

Inspection of Products

For some years much complaint was heard from consumers as to the quality of the majority of the sardines packed in Maine. It was claimed, and with considerable truth, that large and small fish would be used in filling the smallest size cans, the large ones being cut down so they would fit in, this constituting in addition an economic waste of nearly half of the fish; that fish which had been too long out of the water, or had been bruised or broken either in handling or dressing, and fish with "red feed" in them, were canned; that too little care was employed in brining, dressing, drying and cooking the fish, and that unsanitary canneries were altogether too common. While these conditions prevailed in some of the canneries, a number of the others were doing their best to pack a high grade of goods, but the actions of the remainder proved so much of a handicap that finally early in 1916 all but three of the packers came together and formed the "Sardine Section" of the National Canners Association and entered into an agreement to support a reasonable and thorough plan of inspection, to abide by the rulings of the association, and to pay an assessment of two cents on every case of sardines packed to defray the expenses of this inspection. The appointment of the director of inspection and the inspectors (now numbering about 20), as well as the formulating of rules and regulations, was left entirely in the hands of the officers of the National Canners Association. The duties of the inspectors are to see that only fish of good quality are received and packed at the factories, and that the sanitary requirements are lived up to. These

*From U. S. Commerce Reports, No. 157, for July 7, 1917, p. 73.



SARDINE CAN-MAKING PLANT.

requirements are about twenty in number, covering cleanliness of factory equipment and provisions for the comfort and welfare of the employees.

When fish of proper quality are packed in accordance with the association's requirements, the packer is entitled to receive a certificate of the association, to be attached to each case of sardines packed. These certificates are issued to the packer only after the inspection of each lot of goods and a receipt for them is given to the inspector. The certificate reads as follows:

"These sardines have been inspected and packed under our supervision in accordance with our sanitary requirements for packing sardines. National Canners Association. H. M. Loomis, Director of Inspection."

In connection with this inspection work the packers authorized the equipment of a laboratory for chemical and bacteriological investigation of problems connected with the industry. This was put into operation in 1917 and several important problems are now under investigation.

As a result of the remarkable expansion of the California sardine industry in 1916 and 1917, many persons took up the business who were unfamiliar with the proper methods to be followed, while a few made but little effort to put up a sanitary product. Complaints from the trade became so many and so insistent that in the latter part of 1917 the packers adopted practically the same method of inspection as is now in force in Maine, and early in 1918 the following regulations were promulgated:

GENERAL REQUIREMENTS

1. No fish shall be used for canning without the approval of the inspector. Whenever practicable the inspector will inspect the fish on the boats and also at intervals, in his discretion, within the

cannery. In the absence of the inspector fish may be received subject to his approval upon arrival. Each canner will be expected to provide a ladder or other convenient means of access to the boats for the use of the inspectors.

2. The cannery, both inside and outside, must at all times be maintained in a sanitary condition satisfactory to the office of inspection.

3. The fish, as well as the sauces or oils, must be handled in a clean and sanitary manner satisfactory to the office of inspection from the time received until disposed of.

4. Sauces and oils must be of uniform high quality and of the grade commonly used for food purposes. Tomato sauce must be made from whole ripe tomatoes and of good consistency.

5. All packs must have a neat, clean appearance. The presence of excessive entrails, slime or blood will not be tolerated.

6. All packs must be of good quality, that is, there shall be no excessive decomposition of the fish and the salting, drying, steaming, frying, oiling, sterilizing or any other essential part of the process shall be done in such a manner that the finished product will be satisfactory to the office of inspection.

7. All packs must be full weight.

8. All packs must be labeled in strict conformity with all applicable food laws.

REQUIREMENTS IN PACKING QUARTER OILS

1. Fish must be clean square cut at the shoulder.

2. Entrails should not appear in more than one fish per can.

3. The fish should be dried and fried.

4. No broken fish shall be packed.

5. Not more than two (2) fish to the can with slightly broken skin will be permitted.

6. Not less than eight (8) fish shall be packed in can.

7. The number of fish in the can should be stamped on the outside of the case, reading 8 to 12, or 12 to 16.

8. Oil should be one-half gallon per case, and/or sufficient to cover the fish.

9. In packing the cans in cases they should be so arranged that the keys will not mar the lithographed tops.

REQUIREMENTS IN PACKING HALF-POUND SQUARES

1. The fish must be dried and fried.

2. The oil used should run one gallon of oil per case, and/or sufficient to cover the fish.

3. Must run six to ten or ten to sixteen fish to the can.

4. The number of fish to the can should be stamped on the outside of the case.

REQUIREMENTS IN PACKING OVALS

1. The fish should be dried and fried.

2. One pound ovals should contain not less than four (4) fish.

3. The approximate number of fish in the can should be stamped on the outside of the case.

4. Tomato sauce should run one gallon of good, thick tomato sauce per case.

5. Fish in one-pound ovals may be soused or packed in mustard, kippered, smoked or split.

6. Number does not apply to kippered or split.

REQUIREMENTS IN PACKING ROUND CANS

1. Bellies must be sound.

2. Minimum number of fish in round cans shall not be less than five (5). Maximum number of fish in round cans shall not exceed twelve (12) in quarters and halves and fifteen (15) in ones.

3. May be packed in mustard, tomato or oil.

ISSUANCE OF CERTIFICATES

Certificates will remain in the custody of the office of inspection until issued.

Certificates are numbered serially and a record of their issuance will be kept by the office of inspection.

Certificates will be issued only at the request of the inspector and after samples of the pack have been examined and approved by the director or assistant director of investigations.

Certificates will not be issued until cases are packed.

Certificates will not be issued to any canner until his guarantee fund has been paid in full.

Daily packs on which certificates are to be issued must be stored separately.

Inspectors shall have access to packing and storage rooms.

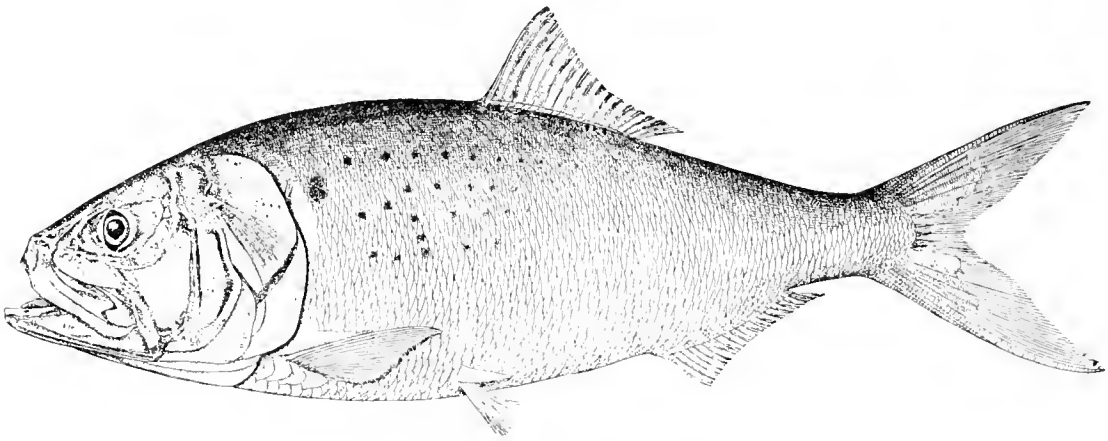
Failure to comply with any portion of the regulations will be deemed sufficient cause for refusal of certificates on the pack involved.

Pilchards

In British Columbia and on Puget Sound the pilchard, as the California sardine is known, is put up by some of the salmon canners in 1-pound tall cans. A much neater package could be prepared by using an oblong can and putting the fish in by hand, same as sardines, but this would require the installation of special machinery for handling this special-shaped can, and thus force the salmon canners out of the business. Under present methods the filled cans are run through the exhaust box for about 10 to 15 minutes at 212° F., and sealed in the double-seamer, and cooked for 45 minutes at 242° F.

As this species is especially abundant from September to December, or just after the run of salmon is over, it makes an excellent fish for handling at these plants, which would otherwise be idle during the period in question.

SHAD



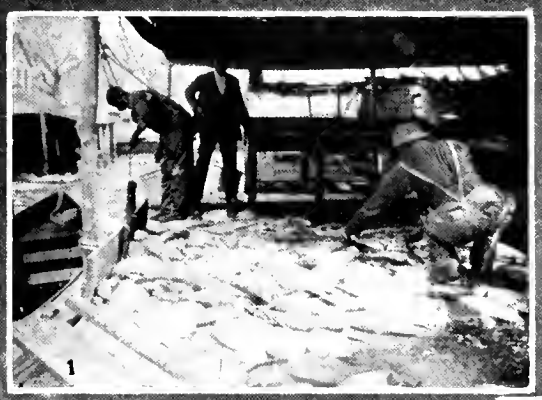
THE SHAD *(Alosa sapidissima).*

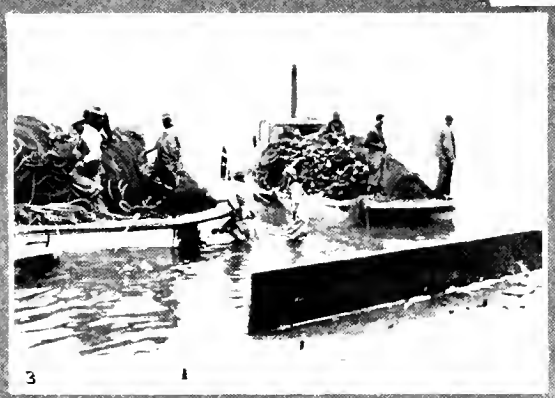
The only section in which this well known species is canned is on the Pacific coast. The species is not indigenous to this region, but was first introduced through the efforts of the California Fish Commission in 1871, 10,000 fry being planted in the Sacramento River. Since then a number of plants have been made by the U. S. Bureau of Fisheries in the Sacramento, Columbia and other rivers. Owing to the migratory habits of the species its range has been extended naturally from southern California to Alaska, but it is not abundant anywhere except in the Sacramento and Columbia Rivers.

In the Sacramento and San Joaquin Rivers there is but one distinct run of shad each spring, and this begins about the first of March and lasts until the first of June, the height of the run being in April. A few shad, however, are taken here and in San Francisco Bay in striped bass and salmon nets practically the year round. Shad ascend the Sacramento River for 300 miles or more.

In California shad fishing is practically all done with drift gill nets having a stretched mesh of from 5½ to 6½ inches. The regular salmon boat and gear are used, but the gill net is of smaller mesh and of somewhat lighter twine. The nets are from 150 to 350 fathoms long and 25 to 65 meshes deep.

In the Columbia River shad are caught mainly in haul seines operated for salmon from April to July inclusive. They are regularly found as far as the Cascades, 150 miles above the mouth, a few even going higher up. The fish is found in greatest abundance





SHAD FISHING IN NORTH CAROLINA.

1—Pound Net Fish on Packing Floor; 2—The Catch on the Beach; 3—Steam Floats Preparing to Set the Haul Seine; 4—Hauling the Seine on the Beach.

from the mouth of the river to a short distance below the mouth of the Willamette River. They are usually spawning in May, June and July.

The shad is the most important anadromus species of the Atlantic coast, being especially abundant in the fresh and brackish waters of North Carolina, Virginia, Maryland, Delaware, Pennsylvania and New Jersey. Every state bordering on the Atlantic supports a commercial fishery for this species and in some it is the most important of all. The time of the appearance of the shad varies in different rivers. They first appear in St. Johns River, Florida, usually in November, but not in great abundance until February and March, and appear a little later in each stream as one goes north, the run not beginning in Maine until in May.

As stated above, no shad are canned on the Atlantic coast, due to the great popularity of this species in a fresh condition, and to the fact that canning of fishes other than sardines is an insignificant business on that coast. On the Pacific coast the canning of shad is carried on as a side line by the salmon canners, the fish usually appearing when salmon are scarce, and as a result their canning helps to keep the regular force busy. The first fish were put up some ten years ago, and like all other new canned products the work of finding a market has progressed but slowly. Being virtually a waste product of the Pacific fisheries, the fish in a fresh state have cost the packers but little, and as a result they have been enabled to offer them at a low figure. The price obtained is regulated largely by the prices of low-grade canned salmon, being usually five or ten cents a dozen cans lower than canned chum salmon. At present the product finds a market mainly on account of its cheapness, but the time is rapidly approaching when the good qualities of the product itself will fix its intrinsic value and it will then sell at a higher figure. Fortunately the industry can be expanded to an almost indefinite extent as the supply of shad in the season is very heavy.

In canning shad the fish are scaled and then dressed by having the head, tail and fins cut off, split down the belly and entrails removed, after which they are thoroughly cleaned both inside and outside. They are then cut to the proper length to fit the can in a machine used for cutting up salmon. The fish pass through the regular machinery used in canning salmon, and are generally packed in 1-pound tall cans. Some canners run the fish through the exhaust box for 4 minutes, while others do not exhaust at all. They are processed for 1 hour and 20 minutes at a temperature of 242° F.

A few years ago a canner on the Columbia River packed some shad without exhausting in any way. In processing the cans were cooked 100 minutes with from 10½ to 11 pounds pressure at a temperature of 240°, and the resulting product is said to have been excellent.

Kippered Shad

A few shad are at present being kippered and canned, and there will probably be a big development along this line, as the product is meeting with much favor.

When landed at the fish house the head and scales are removed, the fish split down the back, the point of the knife passing close along the left side of the backbone to the abdominal cavity, and thence to the tail, after which the fish may be opened flat. The entrails are removed and all blood lodged near the backbone or in the body cavity scraped off. Three short, deep cuts are then made along the side of the fish so as to give the brine and smoke a chance to penetrate into the thick sides and oily dark meat.

The dressed fish are now placed in a brine testing about 10%, and allowed to soak here until all the slime and blood have been washed off, after which they are removed and allowed to drain.

As soon as drained the fish are immersed completely in a strong brine, about 75% saturated, and allowed to remain here for about two hours. As soon as taken from the brine the shad are hung on sticks or hooks, whichever the smoker may have found best for his purpose, the flesh side being out. These are then placed in the sun, on a frame or scaffolding, preferably in a light and airy place that is protected from dust and flies, and allowed to remain here until the fish have dried sufficiently for smoking. In damp weather the drying may be done in the smokehouse by using low fires and a good air circulation through open ventilators.

Any ordinary smokehouse in which a temperature of from 80° to 125° F. can be easily and continuously maintained will answer for this work. In kippering shad the temperature should be kept at not more than 112° to 113° and under no circumstances higher than 120° F.

The shad are now placed in the upper part of the house. Two or three small fires are built of some hard wood, such as oak, maple, birch, alder, etc., but in no case of pine, redwood or any wood containing resinous or turpentine-like material. The wood should be dry, and as soon as it begins to flame vigorously should be smothered with dry hardwood sawdust in order to produce the maximum amount of smoke and to maintain the temperature at the desired point. Several Fahrenheit thermometers should be suspended among the fish and the temperature maintained at about 112° to 113° F. As stated above the temperature should never be allowed to go above 120°, and if it shows a tendency to do this the upper ventilators should be opened in order to let out the hot air and the burning wood smothered. For canning purposes the shad should be smoked for 7 or 8 hours, or even less may be sufficient to give the desired flavor.

At the end of the smoking period the fires are put out and all the doors and ventilators opened in order to allow the fish to cool. This cooling should be allowed to go on for 6 to 12 hours. The fish are then cut to fit the size of can in which it is to be packed, and placed in it with a small amount of 5% brine added. They are then sealed and the cans cooked for about 80 to 90 minutes at a temperature of about 242° F. The time of cooking will vary somewhat at different places.

SMELT

The American smelt (*Osmerus mordax*) is *the* smelt of America. It is found along our Atlantic coast from Virginia to the Gulf of St. Lawrence, entering streams, and is often landlocked. It is abundant in Lakes Champlain and Memphremagog, and in many other lakes in New England, New Brunswick and Nova Scotia. It enters our rivers and brackish bays during the winter months for the purpose of spawning, when it is caught in immense numbers in nets, and by hook and line. Many are taken through holes cut in the ice, and are frequently frozen naturally. Those which have not been frozen are termed "green" smelts, and are much more highly esteemed. The smelt does not usually exceed 8 or 10 inches in length, but it sometimes exceeds a foot in length, and a weight of a pound.

The Pacific smelt (*O. thaleichthys*) is found on our Pacific coast from San Francisco northward to Bristol Bay in Alaska, and is fairly common. The flesh of this species is soft and does not keep well, but is of excellent flavor. The fish attains a length of from 8 to 9 inches.

Under the heading of smelts have been included several well known and closely related species, all of which are eminently suitable for canning in the same manner as smelts.

The eulachon, or candlefish (*Thaleichthys pacificus*), or, as it is frequently called, the "Columbia River smelt," has been described as being "the finest food fish in the world

—tender, fragrant, digestible." It is probably the fattest of fishes, but its oil has a peculiarly delicate, agreeable flavor and, when extracted, is solid at ordinary temperatures. In the abundance and consistence of its fats its nutritive value is more like that of the best grades of meats than is the case with most other fishes. Like the salmons, the eulachon has the habit of running into rivers and brooks to spawn, and is found from Oregon northward, running in the Fraser, Nass and other streams of British Columbia, Washington and Alaska in enormous numbers. They are slender fish—when adult about a foot long—and although resembling the smelt in form, lack its brilliant silvery sheen.

The capelin (*Mallotus villosus*) is found on both coasts of Arctic America, south to Cape Cod and British Columbia. It is a most delicious fish, much valued in the north, and is found in almost countless numbers.

The surf smelt (*Hypomesus pretiosus*) attains a length of a foot and is found on the coasts of California, Oregon and Washington, from Monterey northward, usually abundant and spawning in the surf. It is a firm-fleshed and fat little fish of delicious flavor, scarcely inferior to the eulachon.

In Canada, in 1916-17, the catch of smelt amounted to 6,862,900 pounds, of which 5,502,500 pounds came from New Brunswick waters and the remainder from Prince Edward Island, Nova Scotia, British Columbia and Quebec in the order named. During the same year the catch of capelin (all from Quebec) amounted to 4,556,800 pounds, while the catch of eulachons amounted to 1,269,000 pounds, of which practically all came from British Columbia. There is room for an immense increase in the catch of capelin and eulachons in Canada and Alaska, as the immense runs of these species have hardly been touched as yet.

In 1908 the smelt catch of the United States amounted to 4,340,000 pounds, of which 3,645,000 pounds were taken on the Pacific coast.

The canning of the eulachon has been taken up recently on the Cowlitz River with considerable success. The canning of smelts proper has never attained to much prominence, however, due doubtless to an abundance of sardines, the fish with which they would compete. The methods of canning are not well established, and the following should be considered as merely aids in the experiments which should be undertaken by the intending canner for the purpose of establishing correct methods.

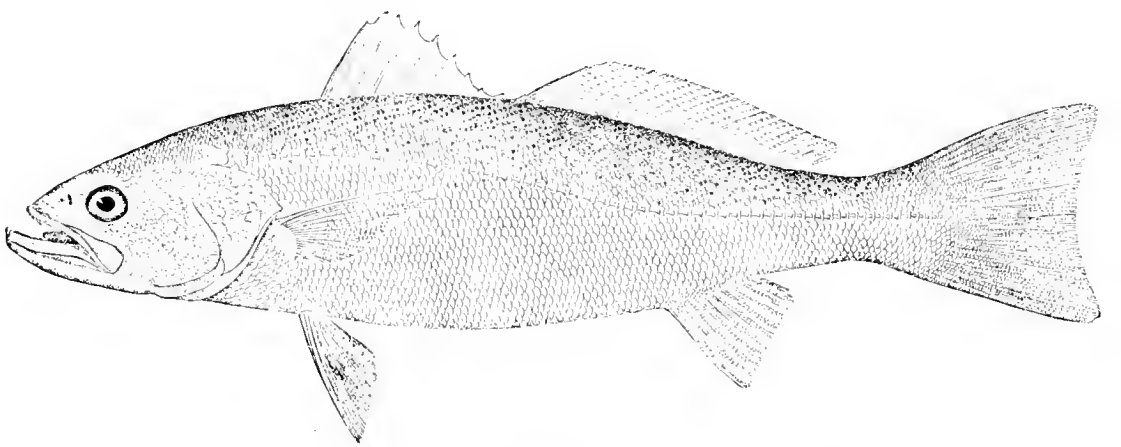
For canning in a fresh condition the fish should be headed, dressed, and then dried in an artificial dryer, or in the sun, for from one to two hours. They should then be packed in cans with oil, tomato or mustard sauce, topped loosely, exhausted for about 10 minutes at a temperature of about 212° F., tops sealed tight, and then processed at a temperature of 240° F. for a period which can only be determined by experiment, but which should probably be from 50 to 70 minutes. If the fish show a decided tendency to mush they should be first soaked for about an hour in a 90° brine in which from one-half to one per cent. of alum has been dissolved, which may possibly aid in preventing the tendency to mush.

The fish are sometimes lightly smoked in a round condition. When prepared in this way the fish should be soaked first in a 90° brine solution for 1 or 2 hours (the time to be determined by experiment) after which they should be hung in the smokehouse and lightly smoked and then packed in 1-pound oval cans and exhausted and processed as above.

Another method of canning is with spices. The fish are cleaned and washed in one or two waters, after which they are salted over night. They are then washed again, put on flakes and either dried in the sunlight or in an artificial dryer for an hour or two. To one gallon of vinegar use two tablespoons of ground mustard, one tablespoon cayenne

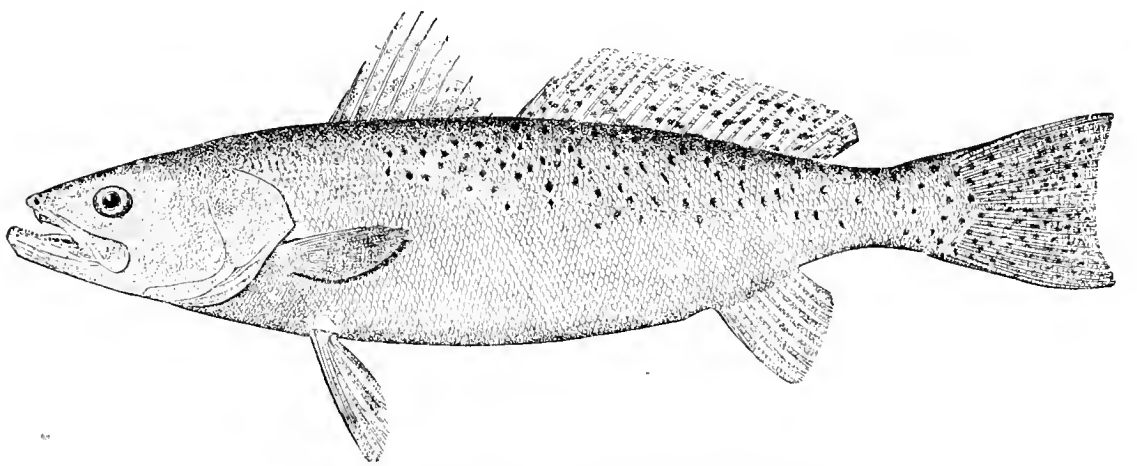
pepper, one tablespoon mace, one tablespoon whole allspice, and one tablespoon cloves. Put spices into vinegar and let it come to a boil before pouring over the smelt when packed in the can. The cover is then put on and after exhausting the cans are processed for about one hour (the period can be determined definitely by experiment) at a temperature of about 240° F. The quantity of mustard should be varied to suit the taste.

SQUETEAGUE OR WEAKFISH, AND WHITE SEA BASS



THE SQUETEAGUE OR WEAKFISH *(Cynoscion regalis)*.

The squeteague, weakfish or sea trout (*Cynoscion regalis*) is found throughout the entire length of our Atlantic and Gulf coasts, and ranges as far north as the Bay of Fundy. It is rare in the Gulf of Mexico, and is most abundant in season off the Middle Atlantic states. It has varied greatly in abundance within the last hundred years, but is always one of our commonest and best known fishes. The fish is found generally close to the coast, but it sometimes runs up tidal waters, and then prefers the vicinity of river mouths. It is highly prized in southern markets. The squeteague reaches a maximum weight of 30 pounds, though examples of more than 10 or 12 pounds are very rare, and the average weight is much less.



THE SPOTTED WEAKFISH *(Cynoscion nebulosus)*.

The spotted weakfish or spotted sea trout (*C. nebulosus*) is associated on the coasts of New Jersey and Virginia with the squeteague, from which it may be readily distinguished by the presence of numerous round black spots on the body posteriorly. Owing to its shape and the spots noted above, it is known on the southern coast as spotted sea trout. It becomes more abundant as we go southward until off the coast from North Carolina to Georgia it is one of the most common food fishes. This species is more migratory in its habits than its relatives. At Beaufort, N. C., it appears from the south in the spring and passes through the inlets on the flood tide. Early in May it proceeds northward, extending its journey as far as Long Island. On the North Carolina coast they are perhaps more abundant than any other species except the mullet. The average weight of the species is from 2 to 4 pounds, though the maximum is much greater.

The bastard weakfish (*C. nothus*) is a well marked species, differing in numerous respects from the others of the genus. It occurs on our South Atlantic and Gulf coasts, and is a good food fish.

Fishing for the above species begins in the latter part of April (they are also quite abundant in the Indian River, Florida, during the winter and early spring), and lasts from six to eight weeks, until the schools begin to move off into deeper and cooler waters. In 1908 nearly one-half of the entire catch was made in pound nets, trap nets and weirs, and one-third in seines.

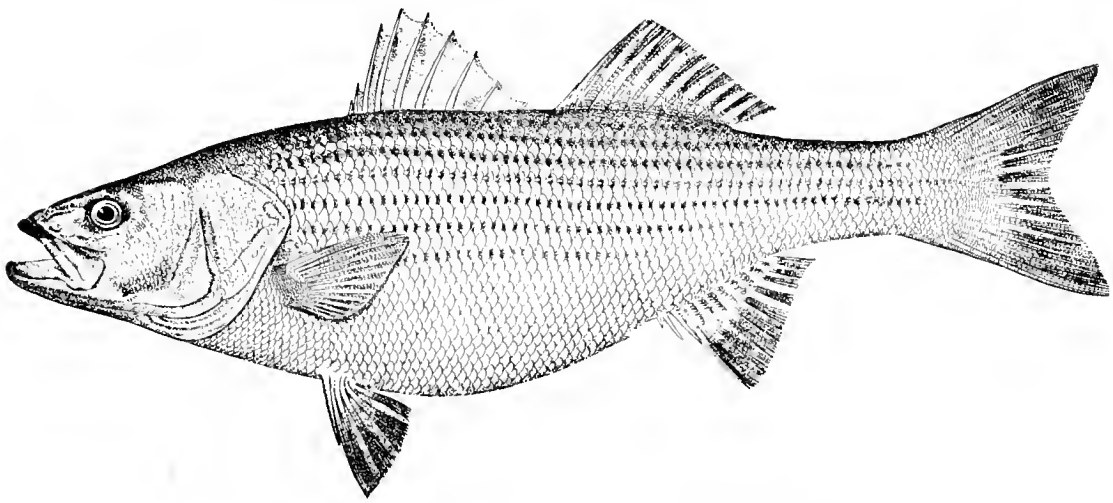
The total catch on the Atlantic and Gulf coasts in 1908 amounted to 48,532,000 pounds, valued to the fishermen at $1,734,000. Of this catch nearly one-half was taken in almost equal quantities by New York and New Jersey fishermen. Every state from Massachusetts to Texas, both inclusive, participated in the fishery.

The white sea bass (*C. nobilis*) is an important game fish of southern California waters. It ranges north to San Francisco and occasionally even to Victoria, Vancouver Island. It is most abundant about Santa Catalina, but is also taken in large quantities in Monterey Bay. It reaches a weight of 20 to 80 pounds, and is an excellent food fish. It comes in schools from somewhere in April and remains late into the summer. During 1917 some 507,079 pounds were taken and marketed by the fishermen, but this quantity could have been largely increased had there been a market available.

The so-called sea trout of southern California (*C. parvipinnis*) is a relative of the white sea bass, but attains a much smaller size, ranging up to 12 or 15 pounds. It is also commonly known as the bluefish. It is found from the Santa Barbara islands to Guaymas and Mazatlan, being common as far north as San Pedro, and is an excellent food fish. During 1917 the California fishermen marketed 83,651 pounds of this species, but this could have been largely increased had the demand existed.

In preparing the fish for canning they are scaled, the gills cut and these and the entrails removed by pulling with the fingers, or else the head cut off just forward of the shoulder and the belly slit to the vent and the entrails removed. The fins are then cut off and the fish cut to can lengths. The fish are then covered with a generous quantity of 60° (salometer) brine and soaked one or two hours, according to the thickness of the fish and the weather; they must remain until all the blood is extracted. The brine should never be used the second time. The fish are then put into cans and the latter filled with brine made by dissolving 3 pounds of salt in each $12\frac{1}{2}$ gallons of water used, and the tops put on. They are then exhausted 10 minutes at 212° F., the tops sealed and the cans processed from 80 to 90 minutes at 240° F., after which they are removed from the retort and placed in cooling bath. Small size fish require less time to process than noted above for the larger fish, the time required probably being from 50 to 60 minutes.

STRIPED AND WHITE BASS



THE STRIPED BASS OR ROCKFISH *(Roccus lineatus)*.

The striped bass, or rockfish *(Roccus lineatus)* occurs on our Atlantic coast from the St. Lawrence River to the Escambia River in western Florida. It is most common between Cape May and Cape Cod and on the North Carolina coast. It is particularly abundant in the great estuaries and open stretches of large rivers. Some years ago it was introduced in Pacific coast waters and is now fairly abundant in California waters, particularly in the Sacramento River.

The striped bass is strictly an anadromus fish, living chiefly in salt or brackish water, and entering fresh water only at spawning time. As a food fish it is one of the very best. Some very large fish have been reported, the largest weighing 112 pounds. The average weight, however, is about 5 pounds.

At one time the species was exceedingly abundant on the Atlantic coast. In 1908 the catch on the Atlantic coast amounted to 1,881,000 pounds, while the California catch amounted to 1,131,556 pounds. The flesh is white and flaky and would can easily, either plain like the squeteague, or corned like the cod. A few were canned on the Sacramento River in 1896. The processing time would be somewhere between 70 to 80 minutes for the small fishes, and for the large fish from 110 to 120 minutes, at a temperature of 240° F.

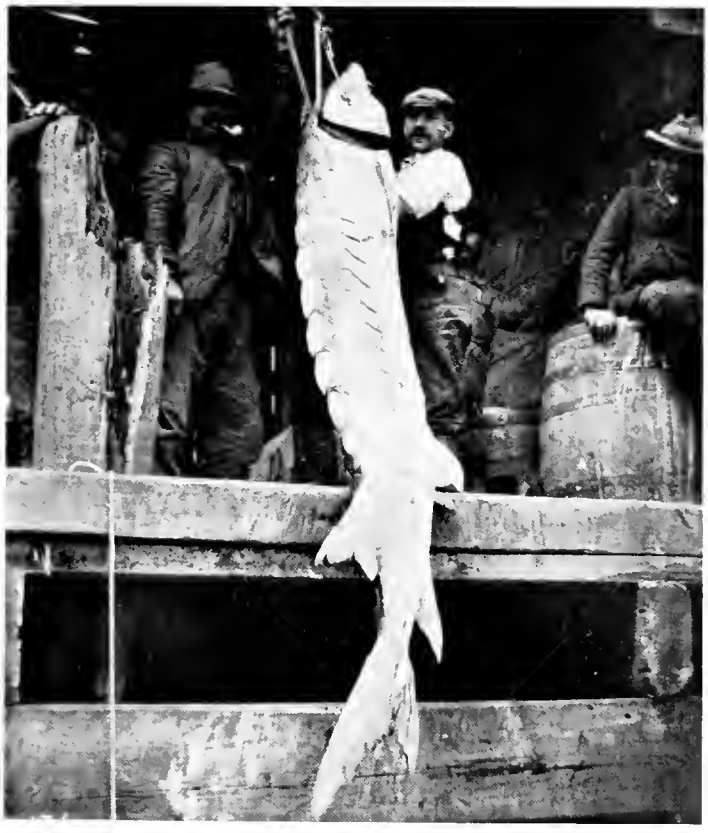
A closely related species is the white bass *(R. chrysops)*, which is found throughout the Great Lakes region from the St. Lawrence to Manitoba, and south in the Mississippi Valley to the Ouachita River in Arkansas. It is generally abundant in the Great Lakes. It does not occur in salt water, but frequents the deep, still waters of the lakes, seldom ascending small streams. It reaches a length of a foot to 18 inches and a weight of one to two pounds. It is an excellent food fish, and could be canned the same as the striped bass. The brine in which it is soaked must, however, contain one-half to one per cent. of alum, as freshwater fish are softer fleshed than saltwater species.

STURGEON

At one time the sturgeon was exceedingly abundant in some of our waters at certain seasons of the year, but the great demand for their eggs in making caviar, and the high prices obtained for the flesh, led to such intensive fishing that they have become

almost extinct at places where they formerly were exceedingly abundant. They are anadromus fishes and only enter fresh water for the purpose of spawning.

The common sturgeon (*Acipenser sturio*) ranges from Maine to South Carolina, and up to 1880 the species was exceedingly abundant. The chief center of abundance was, and is, the Delaware River, although considerable fishing is done in the ocean off Nags Head, North Carolina, and off certain spots on the New Jersey coast. The maximum



LANDING A TEN-FOOT STURGEON.

length of the fish is about 10 feet, and weight about 500 pounds. In all the species the females are much larger than the males.

The short-nosed sturgeon (*A. brevirostris*) ranges from Cape Cod to the coast of Texas. It was at one time quite abundant in the Ocklocknee and Apalachicola Rivers and the rivers debouching into Escambia Bay. This sturgeon is much smaller than the common sturgeon, it rarely ever attaining a length greater than 3 feet.

The white sturgeon (*A. transmontanus*) ranges north from Monterey, Cal., to Alaska, ascending the Sacramento, Columbia and Fraser Rivers in the spring in greatly decreased numbers as compared with a few years ago. This species attains an enormous size; the largest examples of which we have record were 13 feet long and weighed 1,000 pounds. They run usually from April to November.

The range of the green sturgeon (*A. medirostris*) is approximately the same as that of the white sturgeon, but it has never been so abundant and does not attain so large a size as the latter.

SKINNING A STURGEON.

The lake sturgeon (*A. rubicundus*) is found as an inhabitant of the Great Lakes and the larger rivers connected therewith, Lake of the Woods, and many of the Canadian lakes. It is also found in the upper Mississippi Valley, and the lower portions of the Ohio and Missouri Rivers. In the Great Lakes it is most abundant in Lakes Erie and Ontario. The average weight at present is about 40 or 50 pounds, with an average length of about 5 feet.

The shovel-nosed sturgeon (*Scaphirhynchus platorynchus*) is known only from the upper and middle Mississippi valley. It is most abundant in the Ohio, Illinois and Missouri Rivers. It does not attain a very large size. It is caught usually on set lines.

As the sturgeon decreased in abundance the fishermen began seeking a substitute and found it in the paddlefish or spoonbill cat (*Polyodon spathula*). This is one of the most singular and interesting fishes occurring in our waters. Its home is in the bayous and lowland streams of the Mississippi Valley from Texas and Louisiana on the south to Minnesota and Wisconsin on the north. At one time it was particularly abundant in the streams of Arkansas, the lower Ohio, and the Mississippi River in Mississippi and Tennessee. They are usually taken with set lines. Specimens have been caught which were six feet two inches in total length, and weighed 150 pounds, but the average is much less than this. Its flesh is sold as sturgeon meat, while the eggs are used in making caviar.

Canned Smoked Sturgeon

A very small quantity of smoked sturgeon is canned each year. When intended for canning the fresh fish are cut into pieces to fit the size of the can for which they are intended and placed in a wire drum, the cross-section of which is equal to the cross-section of the can. This drum is so arranged that one side or head enters the receptacle and by means of a spring or clasp is pressed into the drum, thus slightly compressing the contents. While it is subjected to the action of the smoke, and as the fish

becomes more and more compact, the movable head will gradually press it against the fixed head, so that the contents take the shape of a disk with comparatively flat sides. The drum is so suspended that it may be turned or rotated from time to time, so that the juice that settles to the bottom is brought to the top and compelled to flow through the mass again, thus retaining it in the flesh. When the smoking is finished the disks of fish are removed from the drum and placed in cans with a small quantity of cottonseed oil, without exhausting, and the cans hermetically sealed. The product is very palatable and will keep for a year or two under favorable conditions. At one time quite a quantity of this product was prepared annually, but the present great scarcity of sturgeon has caused an almost total cessation of the business.

DOLLY VARDON TROUT

Along our Northwest slope and in Alaska is found the Dolly Vardon trout, also known as salmon trout (*Salvelinus parkei*), which is so abundant that it has become a serious menace to the salmon fisheries. It is found in the streams and lakes of the coast states, British Columbia and Alaska. Though a freshwater fish it often descends to the sea and is frequently taken in salt and brackish waters. It reaches a length of 2 to 3 feet and a weight of 5 to 12 pounds. The average is much less, however.

This species is the most persistent and destructive enemy of the salmon eggs and fry. In vast numbers they accompany the spawning fish to the beds with the sole object of feeding upon the salmon eggs when extruded. After the eggs have hatched the fry and fingerlings fall a ready prey to this voracious trout, which pursues them not only in the streams and lakes but down to salt water, where the destruction continues until the salmon have grown large enough to protect themselves.

Large numbers of these trout are taken in the traps and other nets operated for salmon, but little use is made of them at present, largely because of the game laws which make no distinction between this destructive species and other trouts. In Alaska a few are canned in the same manner as salmon, but there is not much demand for them in this shape. It is believed, however, that if the smaller ones were selected and packed whole in 1 and 2-pound oval cans they would present a more inviting appearance, and it is possible a good trade in them could be built up throughout the country, as the trout label would be a novelty in the East, and also one to conjure with, as the name stands for a choice article in the minds of the people.

The following method would probably work successfully in canning whole trout. It should be understood, however, that it is impossible to give exact directions to cover all contingencies, especially with a new and untried product, and the operator will have to use care until he has demonstrated for himself the exact method to be followed. Even with old-established products with which the packer is thoroughly familiar the methods have to be varied from time to time in order to meet unusual conditions which will arise.

In packing the fish should be nearly uniform in size, and should be as fresh as it is possible to obtain them. The head should be cut off and the belly slit to the vent and the entrails removed, or they could be removed without splitting. The fins should then be cut off and the fish washed in clean water, after which they should be covered over with a generous quantity of 60° (salometer) brine and soaked one or two hours, according to the thickness of the fish, care being exercised to see that all the blood is extracted. Fresh brine should be used each time. The fish should be placed with shoulder and tails alternating so they will make a neat and even pack. Then fill the cans with brine (3 pounds of salt to 12½ gallons of water), place the tops on loosely, run them through the exhaust for about 10 minutes at 212° F., after which the tops should be sealed, and the

cans processed at a temperature between 240° and 247° for a length of time which can be determined only by experiment, but probably for about one hour. Should the fish develop a tendency to mush in the cans one-half to one per cent. of alum should be dissolved in the brine in which they are soaked.

The large fish can be dressed and packed in the same manner as canned salmon.

STEELHEAD TROUT

The steelhead trout (*Salmo gairdneri*) is commonly classed as one of the salmons by the canners of the Pacific coast. In different localities the average weight is placed at from 8 to 15 pounds, while extreme sizes reach 45 pounds. The excellent quality of its flesh causes it to be highly prized for the fresh market, but owing to its pale color only limited quantities are canned.

The principal center of abundance of this species is the Columbia River. It is found from Carmel River, California, north to central Alaska, and possibly has an even wider range in Alaska. It seems to be found in the rivers during the greater part of the year. In the Columbia River the spawning season is from February to May, in Puget Sound in the spring, and in southeast Alaska in May and June. The best commercial fishing is in January, February and March. In California the catching of this species is restricted to hook and line fishing.

Wherever used commercially the steelhead is generally caught along with the salmon. Practically all of the steelheads canned are put up on the Columbia River or along the Washington coast.

The actual process of canning steelheads is the same as for salmon, with the exception that they are processed ten minutes longer than are salmon. The reason for this is that the bones of the steelhead are harder than the bones of the salmons and a longer cooking is necessary in order to properly soften them.

TUNA

One of the newest of our canned fishery products is the tuna. The business is carried on solely in southern California, the only place where the species has been found in

SAN DIEGO, CAL., TUNA CANNERIES.

abundance on the Pacific coast. This species was first canned in 1907. No large quantity was packed until 1911, when the two canneries then operating put up about 20,000 cases. In 1912 there were five plants in operation and they packed about 80,000 cases. The output in 1918 amounted to 525,000 cases of all sizes of cans.

While the canned product is labeled tuna, the species utilized is really the albicore, or long-finned tuna (*Germo alalunga*), as it is sometimes called. The albicore is a pelagic species found in all tropical seas, and closely resembles Thunnus, the regular tuna, from which it differs chiefly in having the pectoral long and sabre-shaped, the length in the adult being almost one-half that of the body. It is a comparatively short, but exceptionally thick-set, fish. While specimens weighing as much as 100 pounds have been taken, the average weight is about 30 pounds.

This species is rarely seen on our Atlantic coast. It makes its appearance in the waters of southern California early in the spring, and fishing operations are often carried on as late as December. The fishermen state that during this period the fish often disappear for several months, and it is presumed that they are then spawning.

The albicore is a deep-sea fish, and is taken from two to forty-five miles off shore, moving usually in large, well distributed schools and at a depth of ten or more feet. It is not so active as the leaping tuna (*Thunnus thynnus*) and the yellow-fin tuna (*Thunnus macropterus*), with which it schools.

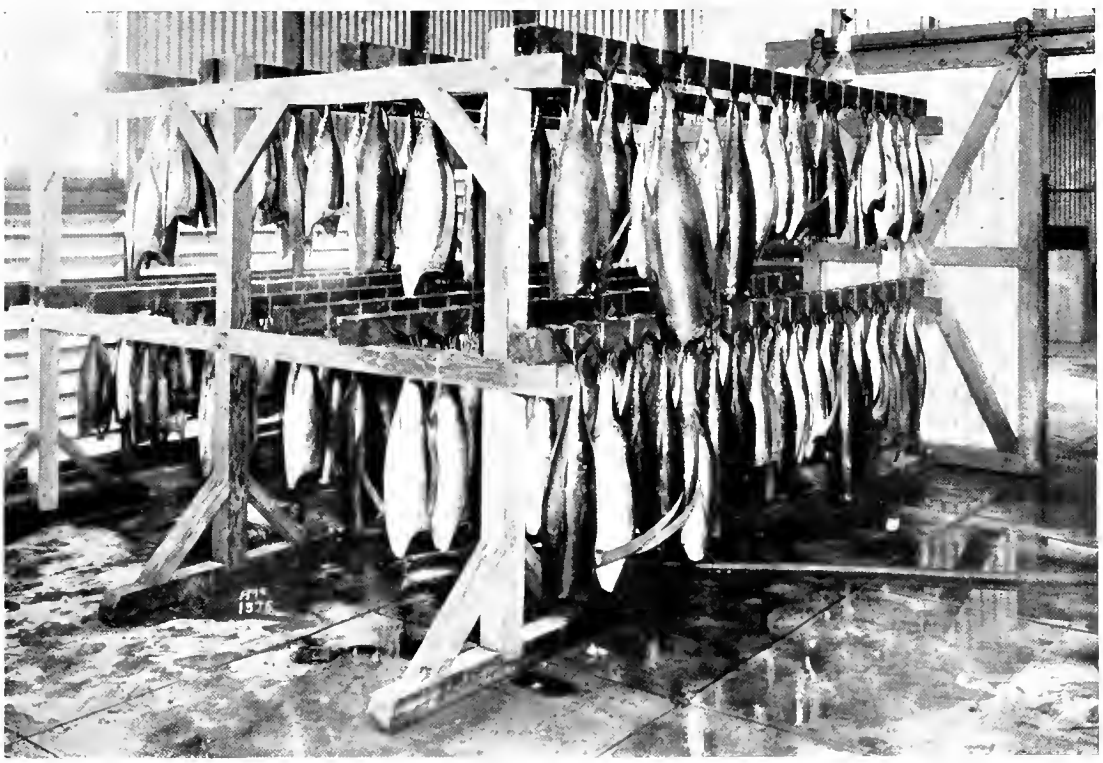
The commercial fishery for this species is a comparatively recent one, although the taking of them has been a somewhat popular sport with anglers for a number of years. Hand trolling lines are used almost exclusively by the commercial fishermen, this primitive form of apparatus seriously handicapping the extension of the business. Unfortunately no better method of catching them has been found, although efforts have been made with floating traps and purse seines, but with indifferent success so far.

CATCHING ALBICORE.

Bait, comprising live sardines, is held in the "live tank" shown on deck.

The boats employed in the fishery are open motorboats with engines of about eight horsepower. Usually three or four men constitute the crew, Japanese and Portuguese predominating.

Before starting out in the morning a quantity of chum bait is prepared by chopping up sardines or other small fish. On the way out sardines are caught in small-meshed seines and these are retained alive in a tank filled with sea water. Upon reaching the grounds a live sardine is placed on the hook and the trolling line paid out, the boat moving slowly forward. At the first bite the engine is stopped and chum (mashed-up sardines) is then thrown overboard, this serving to draw the school close to the boat. The hand lines are baited with sardines and if the fish are in numbers they can be taken



FISH HUNG ON RACKS TO PERMIT OF THE BLOOD DRAINING.

almost as fast as the lines can be cast and hauled. Almost incredible catches are reported as being taken when conditions were favorable.

Daily trips are made to the fishing grounds when the weather permits, the fleet returning each afternoon or evening to the canneries. The fish are dressed on the home trip by removing the viscera and head.

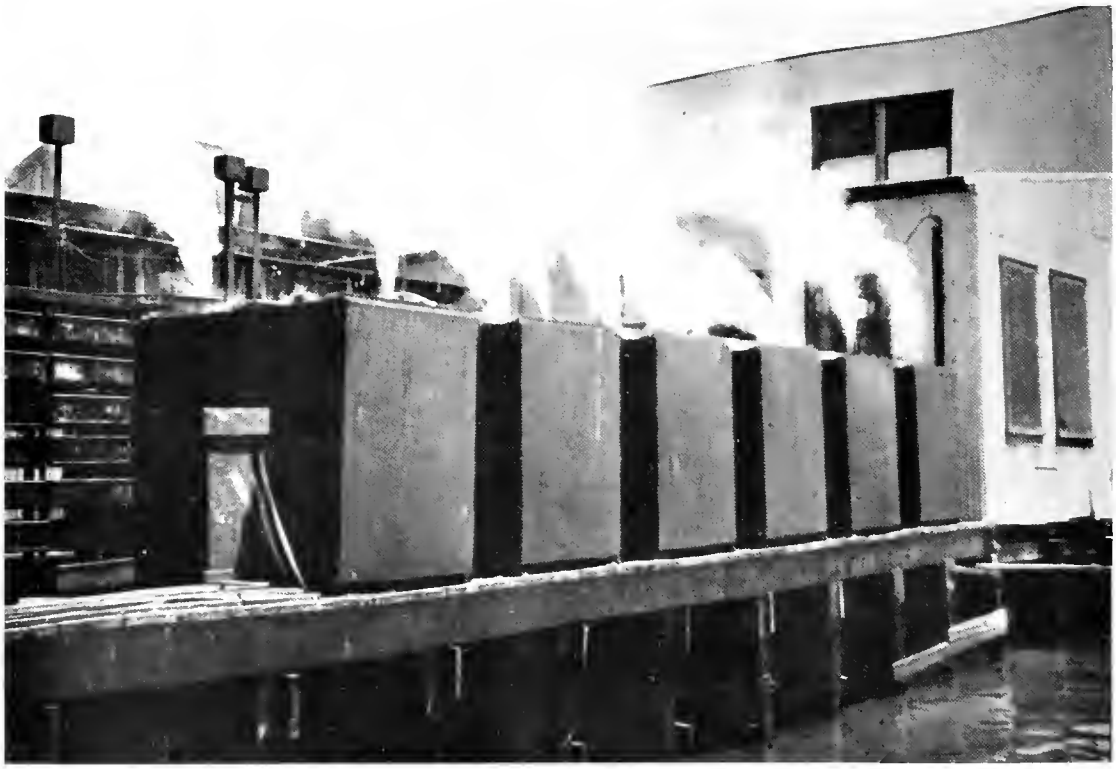
The tuna (*Thunnus thynnus*) is canned on the Mediterranean, and considerable quantities of same are imported into this country from Italy, and meets with a considerable sale amongst the Italians and other South European peoples resident in this country.

On the Atlantic coast this species is found as far north as Newfoundland, and is known as the tunny, horse mackerel or great albacore. They appear on this coast early in the summer and remain until October, being very abundant sometimes, and it is strange that with the great demand now for canned tuna some one has not taken up the business. Despite their great size (a length of 10 or more feet and a weight of 1,500

pounds has been recorded) they are not difficult to catch. Owing to lack of a market for them but few are saved by the fishermen. Most of those taken are in the fisheries of Massachusetts and New Jersey. They are said to be abundant during the season off Rhode Island.

This species is found on the Pacific coast as far north as Monterey Bay. They are not abundant, and do not attain to such a large size as on the Atlantic coast, the largest taken by the anglers weighing but 251 pounds.

In the neighborhood of the Hawaiian Islands is found another member of the albacore family, *Germo germo*, known locally as ahi, while the bonito (*Gymnosarda pelamis*),



COOKING THE FISH.

known locally as the aku, is also found. Both are abundant and are now being canned by local packers.

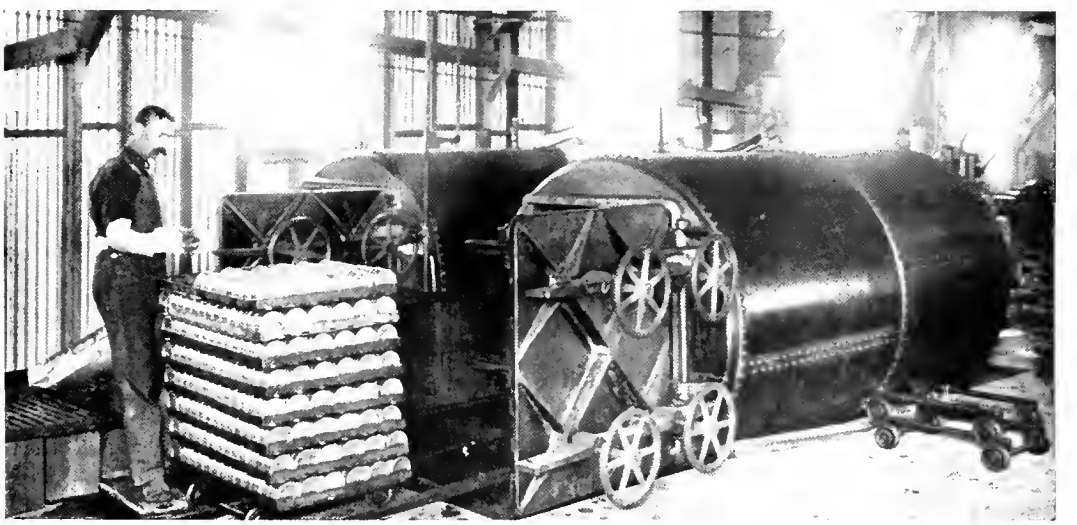
On being delivered at the cannery the fish are first washed in brine and then in fresh water, after which they are hung by the tail from racks to drain the blood and thus insure the whiteness of the flesh. (If the fish were bled by having their throat cut when first caught a considerable part of this work would be unnecessary.) After draining the fish are placed in iron meshed trays or pans (usually three fish to a pan) in a large low-pressure retort, where they are cooked with live steam for about three hours (depending upon the size of the fish; the large fish require the longest time), at practically no pressure, or a temperature of 212° to 220° F. This cooking is for the purpose of softening the flesh, loosening the skin and trying out the oil. As the fish usually arrive at the canneries in the late afternoon or evening, the night is generally devoted to this stage of the process. Upon removal from the cookers they are run into the cooling room, where they are cooled by means of fans.

In the morning the cooked fish are transferred to the cutting and filling tables. Here the girls, standing on one side of the long tables, break the fish in two longitudinally and remove the backbone. The skin and dark layer of meat just under same are then removed

PUTTING THE TUNA IN CANS.

This Picture Was Taken at the Plant of the Los Angeles Tuna Canning Co., at Long Beach, Cal.

with knives, after which the flesh is cut into sections of the proper size to fill the ¼-pound, ½-pound and 1-pound flat cans in which the product is packed.



FINAL COOKING OF THE CANNED FISH IN RETORTS.

In the center of the table are two endless belts running in parallel grooves. At the head of the table a chute running from the mezzanine floor to one of the belts delivers

the empty cans to it, and while it is covering this distance each can is automatically provided with ¼-ounce of fine salt and a teaspoonful of cottonseed or some other pure nut oil, to supply the lack of natural oil in the flesh of the fish. The girls on the filling side of the table remove the empty cans from one belt, fill them with meat, and then place them on the other belt, which carries them to the topper, then through an exhaust box for 11 minutes at a temperature of 210° for halves, and 15 minutes at 220° for pounds. A few packers do not exhaust at all. In some of the plants a vacuum machine is used for the purpose of exhausting the cans and does the work in an excellent manner. They then pass through the washer, where the outsides of the cans are cleaned, and then are transferred in coolers to the retort and once more cooked, this time for about 55 minutes at a temperature of 240° for halves, and about 65 minutes at a temperature of 240° F., and a steam pressure of 12 pounds for 1-pound cans. The cans are then cleaned, cooled, tested for leaks, labeled and boxed for shipment. The cans are not lacquered as in the case of salmon.

It is estimated that a ton of fish will fill 23 cases of 48-one-pound cans each, or 45 cases of 48 ½-pound cans each of the white meat.

A few of the packers let the dark meat go along with the refuse material to the gurry scow, which transports it to the fertilizer plant, or, if the cannery has a fertilizer plant attached, direct to it on an endless belt. The majority of the packers, however, use the dark meat and the small scraps and bits from the white meat in making what is termed potted, or deviled, tuna, this being packed in ½-pound and ¼-pound cans. These are exhausted and processed the same as the white meat. In preparing this product the meat is run through a grinder; spices may or may not be added, as the packer wishes.

UTAH LAKE CHUB

The Utah Lake chub (*Leuciscus lineatus*) is one of the largest and most widely distributed species of this genus, and is abundant everywhere in the Great Basin of Utah, and in the Snake River basin above Shoshone Falls. In Utah Lake it is exceedingly abundant, as it is also in Jackson's Lake, Yellowstone Lake and other similar waters, where, owing to its large size, it is of considerable importance as a food fish. It attains to a length of from 12 to 15 inches. In 1916 the canning of this species was begun by a plant located at Utah Lake.

WHITEFISH

Whitefish are among the most important freshwater fishes of America, and rank high as food fishes.

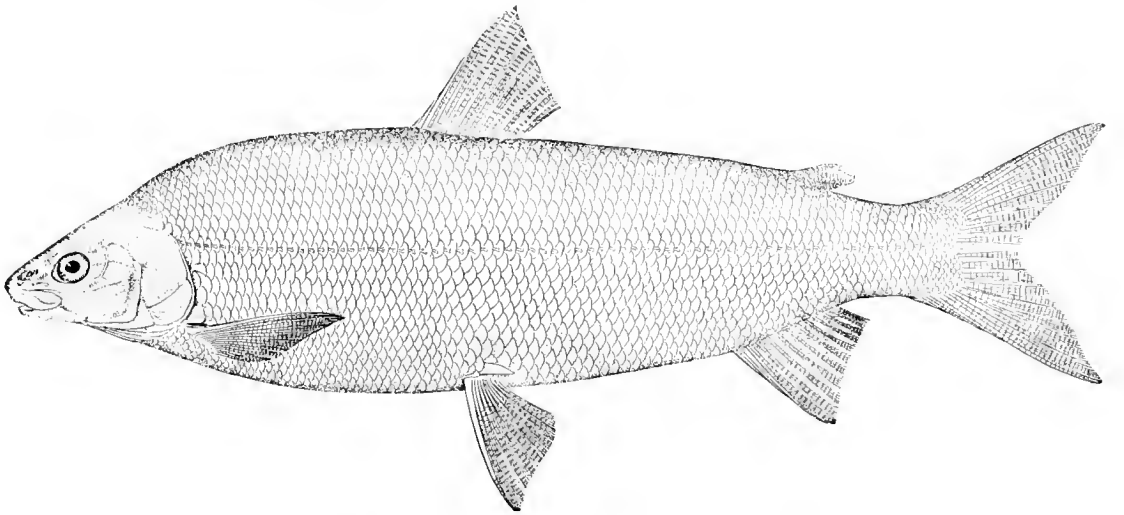
The common whitefish (*Coregonus clupeiformis*) is the most valuable species of all. It is found throughout the Great Lakes region from Lake Champlain to Lake Superior, and possibly to Lake Winnipeg. The common whitefish lives habitually in the deeper waters of the lakes, coming out into more shallow water at spawning time, which, in the Great Lakes, is from late October into December. Fishing is carried on in all months except January, February and March, when the whereabouts of the fish are unknown. In Lake Erie the fish ranges from about 1½ to 5 or 6 pounds, but seldom exceeds 4 or 5 pounds. It attains a weight of 12 pounds or more, and some have been reported weighing as high as 20 pounds. Gill nets are the favorite form of apparatus, although pound nets, trap nets and seines take considerable. The trade is centered chiefly at Chicago, Detroit, Sandusky, Cleveland, Erie and Buffalo.

The Rocky Mountain whitefish, or mountain herring (*C. williamsoni*), has a very wide distribution, occurring in all suitable waters from the west slope of the Rockies to

the Pacific and from Utah to British Columbia. It prefers the cold, clear lakes, such as those of Idaho, Oregon and Washington, but is also found in many streams. During the spawning season, which occurs in late fall or early winter, those living in the lakes run out into the tributary streams, in some places in incredible numbers; the rest of the time they spend in comparatively deep water.

This species attains a length of a foot or more, and a weight of about 4 pounds, though the average is somewhat less. Considerable fishing is carried on for this species during the spawning season, the catch being shipped to Eastern points.

The broad whitefish or nuksun (*C. kennicotti*) is known from the Yukon River north in Alaska, and in Great Bear Lake and Mackenzie River in Canada. It is one of the largest species of the genus, and reaches a weight of 30 pounds, and as a food fish is



THE COMMON WHITEFISH *(Coregonus clupeiformis).*

held in high esteem. It is said to be abundant in the Yukon in both winter and summer, and that it spawns in September, when it enters the small tributary streams.

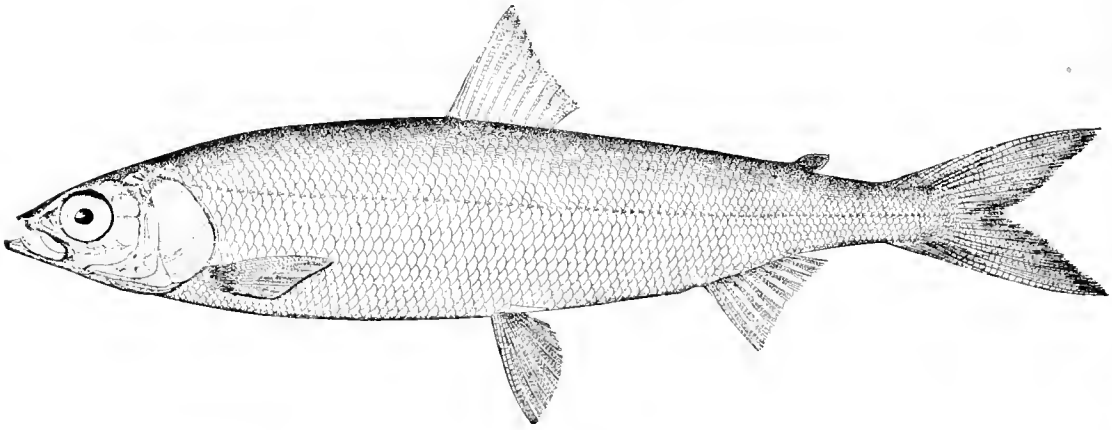
The menominee, or round whitefish (*C. quadrilateralis*), is found in the lakes of Labrador, New Brunswick and New England, westward through the Adirondacks and the Great Lakes, thence northward into British Columbia, Alaska and northern Canada, making it the most widely distributed species of American whitefish. It is ordinarily found in rather deep water of the lakes, and does not often enter streams. It spawns in the fall. The menominee reaches a length of 12 to 15 inches, and a weight of 2 pounds; the average weight, however, does not exceed 1 pound. Lake Champlain and the small lakes of Vermont and New York yield considerable quantities each year, while in Lakes Huron, Michigan and Superior still larger quantities are taken, gill nets being the gear usually employed for this purpose.

In 1908 the combined American whitefish catch from the Great Lakes, Lake of the Woods and Rainy Lake amounted to 7,722,000 pounds, the greater portion, 4,772,000 pounds, being taken by the fishermen of Michigan. Large quantities are taken commercially in the smaller lakes of New York, Vermont, Washington and Idaho, of which no record is available.

In Canada during the year 1916-17 the catch of whitefish amounted to 16,499,200 pounds, of which 5,033,900 pounds were take in Manitoba waters, 6,071,100 pounds from

Ontario, 2,855,100 pounds from Saskatchewan, 2,145,200 pounds from Alberta, 309,900 pounds from Quebec, and 78,900 pounds from Yukon Teritory.

LAKE HERRING OR CISCO



THE LAKE HERRING OR CISCO *(Leucichthys artedi)*.

This misnamed species is really closely related to the whitefishes and is a strictly freshwater species with no relationship to the sea herring. The lake herring, or cisco *(Leucichthys artedi)*, as it is frequently called, is found throughout the Great Lakes and northward into the Hudson Bay drainage, and to Labrador.

It is taken in enormous quantities each year and in most of the lakes is the object of a special fishery. In 1908 the catch in the United States was 41,118,000 pounds, of which 12,124,000 pounds were taken in Wisconsin and 14,787,000 pounds in Michigan. The species is most abundant in Lake Michigan (with 21,059,000 pounds), while Lake Erie ranks second in importance with 10,600,000 pounds. Gill nets and pound nets take nearly all of the catch.

The Canadian catch for the year 1916-17 amounted to 5,853,700 pounds, principally in the province of Manitoba.

The fishing begins in the spring, generally early in April, and lasts usually until November. The average weight of the species does not exceed a pound, and the maximum weight two pounds. The fish are marketed fresh, pickled, smoked and canned.

The blackfin whitefish *(Argyrosomus nigripinnis)* is commercially classed with the whitefishes, although scientifically it belongs with the ciscos, and is known certainly only from Lake Michigan and Miltona Lake, Minnesota, though it has been reported from other small deep water lakes of Minnesota and Wisconsin. It has also been reported from Lake Superior, but probably erroneously. The blackfin is probably the most abundant fish of commercial importance in the deeper waters of Lake Michigan. The spawning season occurs in November and December. It is taken usually in gill nets. It reaches a length of 18 inches, and a weight of one to two pounds.

Like the blackfin, the tullibee (*A. tullibee*) is classed commercially with the whitefishes, although it belongs with the ciscos, or lake herrings, and is known from Lakes Onondaga (New York), Erie, Superior and Michigan, also from Lake of the Woods, and in the provinces of Manitoba and Saskatchewan, Albany River and other waters northward. It is especially abundant in Lake of the Woods and in the provinces of Assiniboia

and Manitoba. It is not at all common in the Great Lakes. The tullibee attains a length of 18 or 20 inches and a weight of 3½ pounds. It ranks high as a food fish.

The bloater whitefish, or longjaw (*L. progunthus*) is known from all the Great Lakes except Lake Erie. It is most abundant in Lakes Ontario and Michigan. It reaches a length of 8 to 16 inches, and a weight of a pound or less. It is generally found in deep water.

The process of smoking and canning whitefish and lake herring is identical.

The fish should be split down the belly to the vent, eviscerated, the gills and fins removed, washed thoroughly, and pickled in tubs or barrels, about 4 pounds of fine salt to 100 pounds of fish being scattered among them and sufficient brine of 90° salinity to cover them. Either dry salt or brine alone may be used, the former being preferred in warm weather and the latter during the winter. The brine should be freshly made each time. In case brine alone is used some dry salt should be placed on top to strengthen the weak pickle floating at the surface. From one-half to one per cent. of alum, or some other hardening agent, must be put in the brine as the flesh of freshwater fish is apt to be soft. They should remain here until all the blood has been extracted. If the fish are then to be canned the head should be removed and the fish cut into lengths to fit the can. After placing them in the cans the interstices should be filled with brine comprising 3 pounds of salt to 12½ gallons of water, capped loosely, exhausted 10 minutes at 212° F., sealed and processed 55 minutes at 245° F.

If fish are to be smoked before canning, they are strung on the smoke rods after coming from the pickle. Should it be desired to have the fish well smoked on the inside the abdominal cavity can be stretched open by means of small wooden sticks. The fish are then dipped in fresh water to remove the surplus or undissolved salt, etc., drained and suspended in the smokehouse 4 to 8 feet above the floor, and subjected to a gentle smoke for 4 or 5 hours. The door or damper is then closed, the fires spread or built up, and the fish cooked for 1 or 2 hours, according to the amount of fire, the height of the fish and the particular cure desired. After cooling, which is accomplished either by opening the doors of the smokehouse or by removing the fish to the outside, the fish are taken off the rods, the head cut off and the fish cut into lengths to fit the can.

After placing in the cans the interstices are filled either with brine, oil or sauce, the tops put on loosely and the cans exhausted for 10 minutes at 212° F., sealed up and processed for about 55 minutes at 245° F.

Under a ruling of the U. S. Department of Agriculture (Service and Regulatory Announcements No. 18) all species of *Coregonus* should be called whitefish, while all members of the genus *Leucichthys* should be called lake herring.

WHITING

The whiting or kingfish (*Menticirrhus saxatilis*) has been steadily growing in favor as a food fish during the past twenty years. In 1898 less than 50,000 pounds were marketed, but in 1908 about one and one-half million pounds were sold, while in 1917 11,890,055 pounds were caught in the coasta fisheries of New York and New Jersey alone, while in 1916-17 8,700 pounds were taken in Canada.

The species is found from Cape Ann to Key West and Pensacola, its center of greatest abundance being in the north, and principally along the New England and New Jersey coasts. It is normally a resident of deep waters offshore, but during spring and early summer it comes to our northern coast in vast schools, its migrations to the coast being impelled by the search for food. It reaches a maximum length of about 18 inches,

but its average length is about 12 or 14 inches. They are caught principally by lines, seines and gill nets.

The sand whiting or Carolina whiting (*M. americanus*) is found on our South Atlantic and Gulf coasts from the Chesapeake Bay to Texas. It is very common on sandy shores southward, and is a food fish of considerable importance. This species is most common off the Carolinas, 1,091,000 pounds having been caught here in 1908.

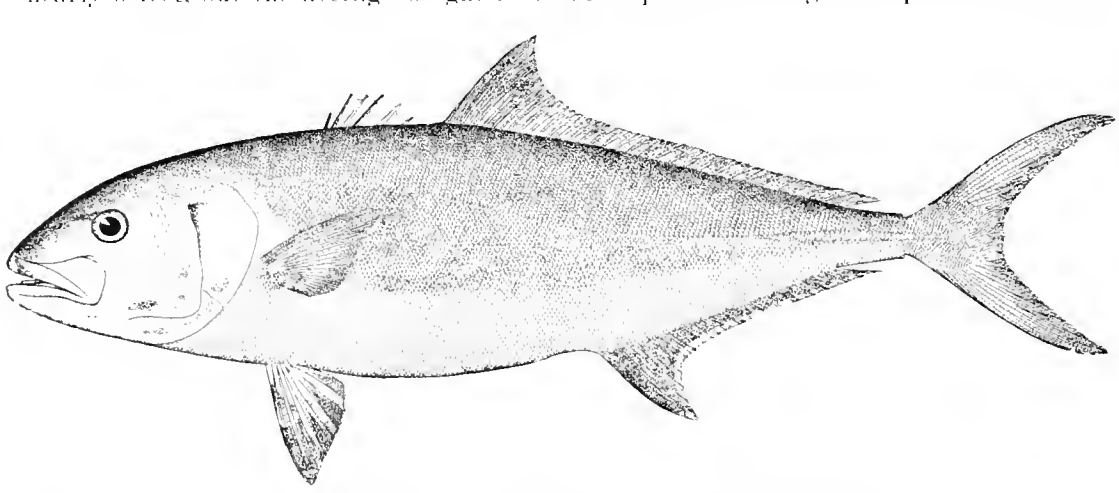
The surf whiting or silver whiting (*M. littoralis*) is found on sandy shores from the Carolinas to Texas and is generally common.

The California whiting (*M. undulatus*) occurs from the Santa Barbara islands southward on sandy shores, and is a food fish of some value.

The whiting is a sweet fish, but unfortunately its flesh is rather soft, which somewhat militates against its being shipped fresh to distant points. Considerable are pickled and frozen, while a few have been canned. It should not be difficult to can this species, and a close perusal of the methods used in packing similar fishes, shown elsewhere in this work, together with a little experimenting, ought to quickly develop the process most suitable for the consuming trade in view. The softness of the flesh may be overcome somewhat in canning by dissolving in the brine in which the fish is soaked one-half to one per cent. of alum or some other hardening agent. Would suggest that the fish be dressed, cleaned and soaked in fresh brine made by dissolving 3 pounds of salt in each 12½ gallons of water used until all the blood has been extracted, usually from one to two hours. They should then be packed in the cans, with ¼ ounce of salt, the tops put on loosely and the cans exhausted for about 10 minutes at 212° F., the tops sealed on and the cans processed at 240° F., 1-pound cans about 50 to 55 minutes, after which they should be removed and cooled in cooling bath.

YELLOWTAIL OR AMBERFISH

The yellowtail (*Seriola dorsalis*) is found on the Pacific coast from Mazatlan and Cape San Lucas north to the Santa Barbara Islands. This species arrives in southern California about March and remains until December, and occasionally throughout the year. In Winter it goes south and off into deep water, being occasionaly taken on the outer banks at that time. The fish attains a weight of 100 pounds and a length of nearly 5 feet, but the average weight is about 20 pounds. The greater part of the catch



THE AMBERFISH OR AMBERJACK (*Seriola dumerili*).

is made with lines. In 1915 1,094,416 pounds, valued at $26,123, were marketed in a fresh condition, and 124,500 pounds, valued at $4,743, in a salted condition.

Several years ago the tuna canners, whose fishermen frequently made large catches of yellowtail, began putting them in cans using the same methods as followed in canning tuna. The demand for the product is steadily increasing as it becomes better known. The canners now use the name amberfish, a name applied to a closely related species found in Florida, in place of yellowtail, on the can labels.

On the Florida coast is found a related species, the amberfish or amberjack (*Seriola dumerili*). It is a not uncommon species in winter and attains a maximum size of 80 pounds or more, although the average size is less than half of this. As on the Pacific coast, the species is taken mainly by trolling, and will can as readily as its California relative.

MOLLUSKS

ABALONE

IT is only within the last three or four years, and then since canning was taken up, that the abalone has been considered as an article of food by white residents of the Pacific coast. It has been highly esteemed, however, for many years as an article of diet by Orientals living in this country, while large quantities in a dried condition were shipped to Asia.

While not a resident of our Atlantic shores, the mollusk abounds along our Pacific coast from San Diego to Alaska. The animal has a single calcareous shell, from 6 inches to nearly a foot in length, and this is one of the most brilliantly beautiful in its interior of any known.

The abalone crawls about the bottom of the ocean, just outside the surf, at a depth of from 20 to 120 feet. A large holding muscle, really the foot of the animal, is attached to the shell near the middle, and with this the animal, when disturbed, clings to the rocks with a tenacity which makes it a difficult matter for the fisherman to dislodge it.

Most of the fishing is done by Japanese, who go down in diving suits and detach the abalone from the rocks by slipping a shucking chisel under the expanded foot of the animal before it is alarmed. The captured abalones are put into a basket, which has been let down by the rest of the crew from a boat at the surface, and this is then hauled up, emptied, and sent down again until the diver is tired and comes to the surface to rest.

The white fisherman usually rows along near the rocks in a boat and examines the bottom through a water telescope (a short wooden box with a pane of glass at one end, through which the bottom can be seen undisturbed by the surface ripples), and when a shell is found it is pried off by a chisel fastened to a long pole, which then is pressed against the body of the animal, so raising it to the surface.

Chinamen also wade along close inshore and pry the abalones off with a short chisel, dropping the shells into a basket.

Practically all of the fishing at present is confined to the coast south of Monterey Bay, but as the product becomes better known to the consuming public the almost limitless supplies along the coast north of here will be drawn upon. Four or five plants were engaged in canning the abalone in 1917. All but the viscera are utilized. The flesh and juice are treated together and the product is said to acquire a flavor more delicate than that of the oyster. It may be stewed or fried, while the juice makes a good broth, soup or appetizer. Being highly albuminous the meat is very nutritious.

Upon arrival at the cannery the meat is detached from the shell by means of chisels, the visceral mass being cut away. It is then put into salt water and allowed to remain here for a couple of days, or sufficient time to remove the black envelope around the foot muscle. For the white trade only the foot muscle is used, and this is sliced and then minced in a meat grinder; but for the Oriental trade both foot muscle and mantle cut into cubes are used.

After packing in cans, usually in 1-pound talls and flats, the cans are run through an exhaust box for 45 minutes at a temperature of 108° F., after which they are run through the double seamer and the tops sealed on. They are then put into retort and cooked one hour under 15 pounds pressure, the temperature being between 240° and

250° F., at the end of which period they are taken out of the retort, sprayed, and then laid out to cool.

In California the best season for canning is in May, June and July. During the winter months the flesh of the mollusk is at its poorest. It spawns during February.

It is strongly recommended by the packers as a health food, containing, it is said, a higher percentage of albumen than any other canned food.

A considerable business is done in the selling of the polished shells, which are highly esteemed as ornaments the world over.

CLAMS

Next to the oyster, the clam is the most important mollusk found in our waters. In 1908 the clam product ranked sixth in value, amounting to 1,900,000 bushels, valued at $1,917,000. Included in this total product were 976,000 bushels of hard clams, valued at $1,317,000; 865,000 bushels of soft clams, valued at $553,000; 26,000 bushels of razor clams, valued at $25,000, and 33,000 bushels of surf clams, valued at $21,000. What few cockles were taken were included in one or the other varieties of the clams mentioned.

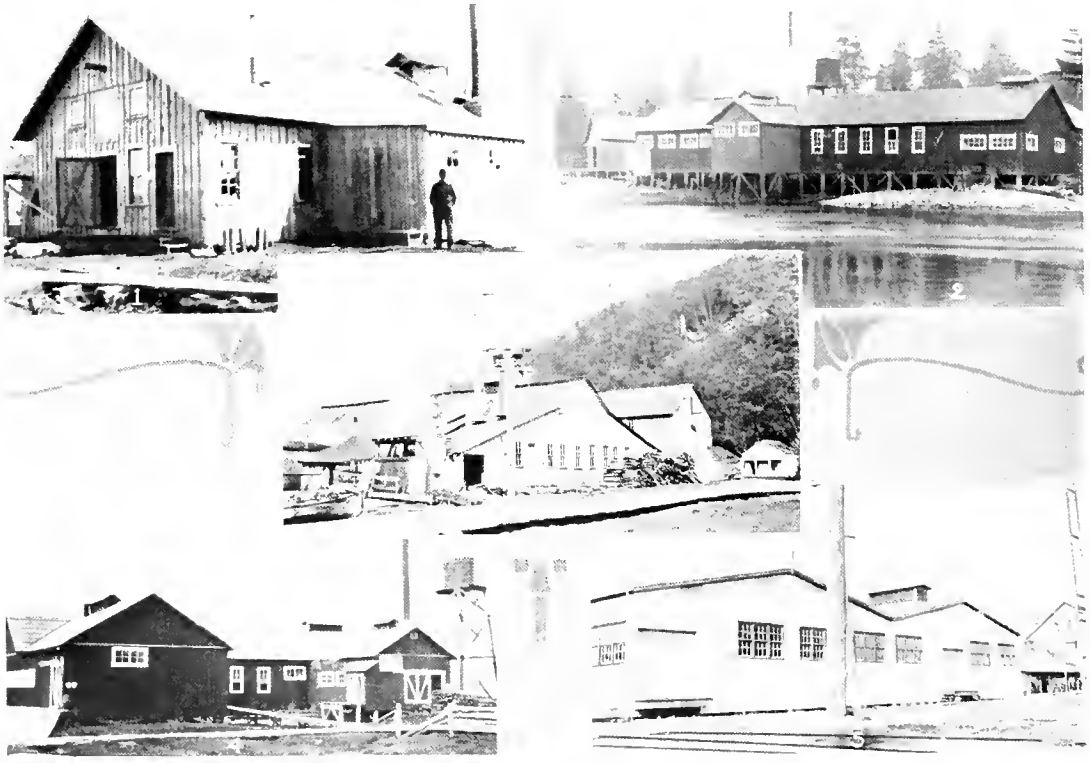
In 1908 Alaska was credited with 850 bushels, valued at $350, all of which were marketed locally. About 1915 the canning of clams was taken up, with the result that in 1918 45,194 cases of clams and 90 cases of clam juice were packed. The next few years will see a great development in clam canning in Alaska, as beds are numerous and but few have ever been worked heretofore except for local use.

In Canada in 1916-17 the production of clams of all kinds amounted to 54,942 barrels, all but 5,538 barrels (from British Columbia) of which came from Atlantic waters. British Columbia will in time be a heavy producer of clams as the location and extent of her beds become better known.

The quahog, hard clam, or round clam (*Venus mercenaria*), is the most important member of the clam family, and is found in abundance from Cape Cod to Texas, but is not much used as a food south of North Carolina. It is the "clam" of the markets of New York, Philadelphia and southward, and it is also utilized to some extent in New England. It has a heavy shell and lives on the muddy bottoms, principally below low-water mark, where it is taken by means of specially designed rakes. Most of the raking is done by hand from sail or power boats, but occasionally one is dragged over the bottom by a sail or power vessel while drifting or moving slowly. Tongs, similar in shape to oyster tongs, are occasionally used, while ordinary shovels are also employed in a few places to dig them up. Many are secured by "treading," i.e., the clammer wades about and feels for the clams with his toes, and then picks them up by hand or with a short rake.

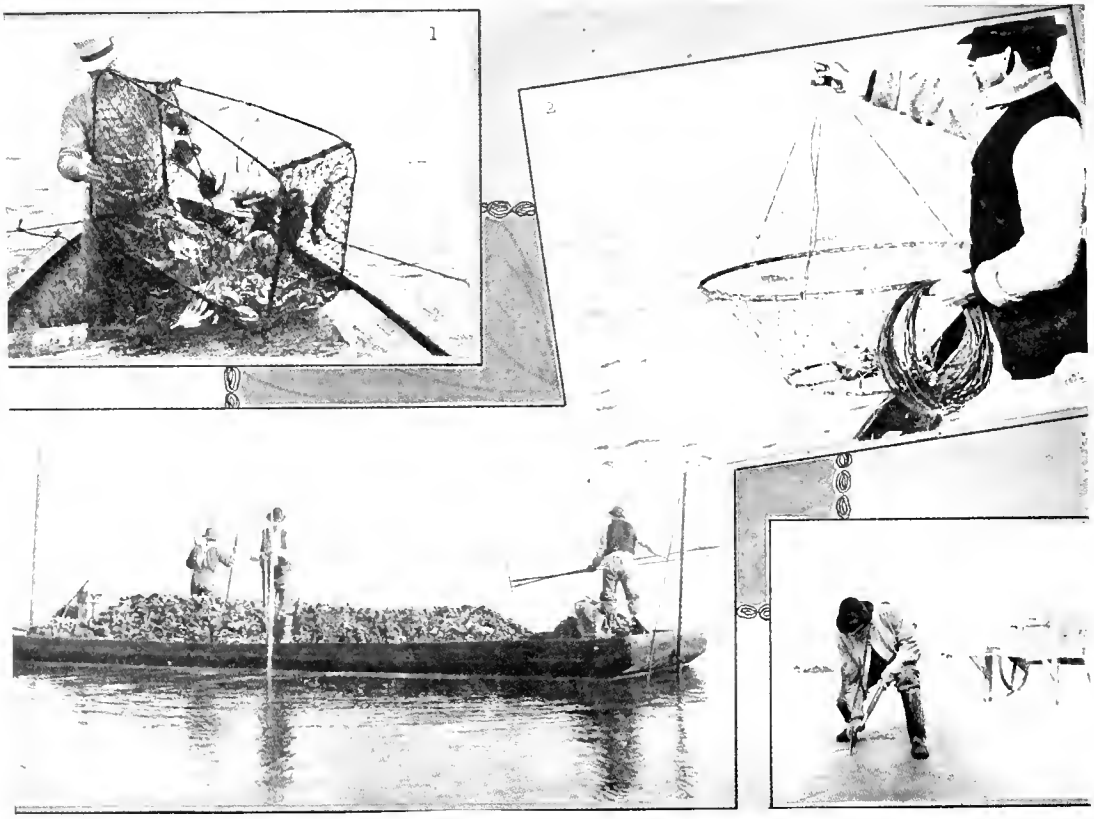
The long clam, or manamose (*Mya arenaria*) is found from South Carolina to the Arctic Ocean. It is scarce south of Cape Hatteras, but is the principal species in the regions north of New York, and on account of the comparative lightness of its shell is often called the "soft clam." It was introduced into San Francisco Bay about 1870 with importations of Eastern seed oysters, later was planted at Santa Cruz, Cal., and in Coos and Umpqua Bays, in Oregon, and in Willapa Harbor, Washington, from which places it has spread widely, and is now an important food product.

The 'soft clam" is found principally on sandy shores or in a mixture of sand and mud, between the tide marks. Its long siphon permits it to burrow to a considerable depth, and it is dug from its burrow by means of spades, stout forks or heavy hoes or rakes, with three or four broad prongs, the mollusk betraying its presence by squirting water up when the sand is shaken or pressed.



SOME OF THE RAZOR CLAM CANNERIES OF THE PACIFIC COAST.

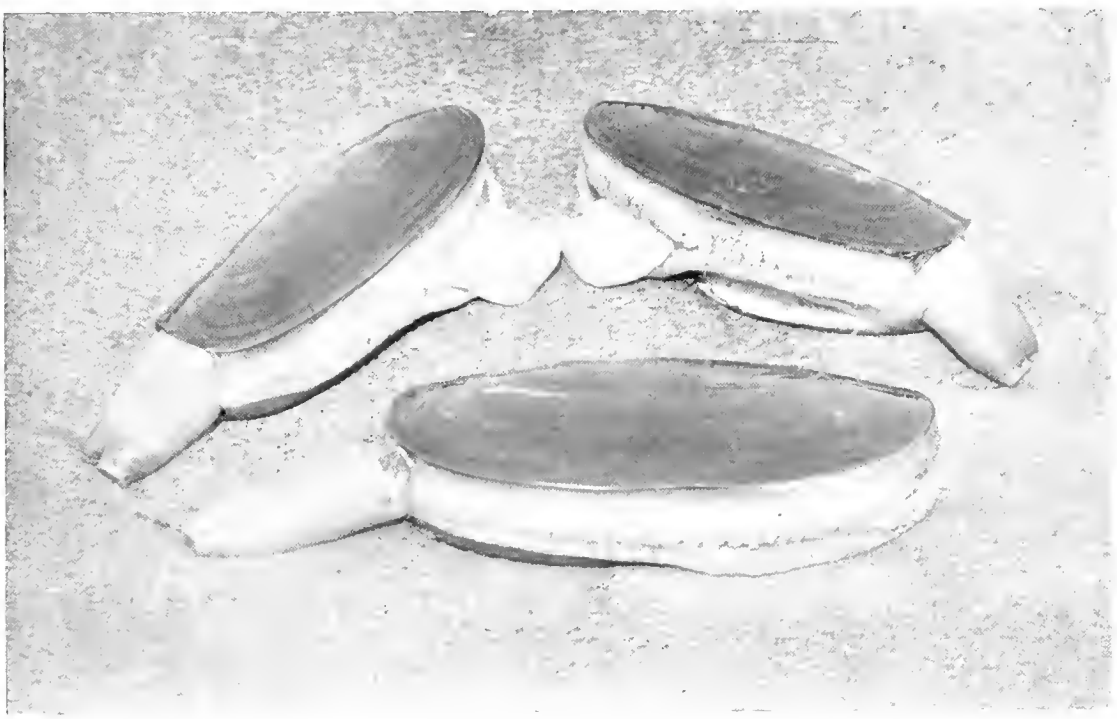
1—Nahcotta Canning Co., Nahcotta, Wash; 2—Copalis, Wash., Plant of Sea Beach Packing Works; 3—Aberdeen Plant of Elmore Packing Co.; 4—Pacific Fisheries and Packing Co., Moclips, Wash.; 5—Surf Packing Co., Aberdeen, Wash.



CLAM, CRAB AND OYSTER FISHERMEN.

1—Emptying a Crab Pot; 2—Ready to Set a Crab Hoop Net; 3—Tonging Oysters in California; 4—Digging Razor Clams on the Pacific Beaches.

The surf clam *(Mactra solidissima)*, which is also known as "sea clam," "hen clam," "skimmer," etc., is found on both coasts and is distinguished by its great size and smooth surface, some of the shells being more than six inches long and four or five inches broad; there is great variation in the form of the shell. On the Atlantic coast it ranges from the Gulf of Mexico to Labrador, but it is only in New Jersey and New York that it is of commercial importance. Owing to the difficulty experienced in freeing the meat from the sand, which its exposed beach habitat causes to accumulate inside the shell, but few are eaten, the great majority being marketed as bait. It ought to be possible for some canner to remove this sand, when he would have an excellent and abundant product for canning purposes.



THE RAZOR CLAM *(Machaera patula)*.

The razor clam *(Machaera patula)* is the most important of the native west coast species, being found on nearly all of the sandy beaches from the southern boundary of Oregon north to the Arctic. The shell of this bivalve is long and sub-cylindrical, resembling in shape a razor. They excavate large elliptical holes, which penetrate downward, usually in a nearly vertical direction, to a depth of two or three feet. Owing to the shortness of their siphons, or breathing tubes, they are obliged to come up to the opening of the hole in order to obtain oxygen and food. When the tide is in, and no danger is near, the end of the shell usually projects above the surface for an inch or two, but a sudden jar startles them, and down they go with great rapidity. Short-handled spades are used in digging the mollusk out.

As the razor clam lives below high water, and is usually most abundant about low tide, the hours in which the diggers can work each day are few. The best digging is during the spring tides, when the greatest run-out occurs, thus exposing more of the beach than in the ordinary tides. The best months for digging are May, April and September,

in the order named, while December is the poorest, on account of the storms usually encountered then. In the state of Washington there is a closed season from June 1 to September 1. About 34 pounds of meats are obtained from 100 pounds of clams as taken from the water.

The little-neck, or hard-shell clam (*Tapes staminea*), the "hard-shelled clam" of the markets, and the butter clam (*Saxidomus nuttali*), both very abundant in all parts of Puget Sound, and only less plentiful in many other places, are the principal clams of the Washington, British Columbia and Alaska markets. Large quantities are used fresh, while many, especially of the last named, are canned.

The great Washington clam (*Tresus nuttali*), which sometimes reaches a length of eight or ten inches, when minced makes an excellent canned product. It is abundant in Puget Sound and is also found all along the coast as far south as Mexico.

Several species of cockles are also found on the Pacific coast and are occasionally canned along with the clams.

A large business is done in New England in canning soft clams; in the Middle, South Atlantic and Gulf states in canning quahogs, and on the Pacific coast in canning razor, little neck and butter clams.

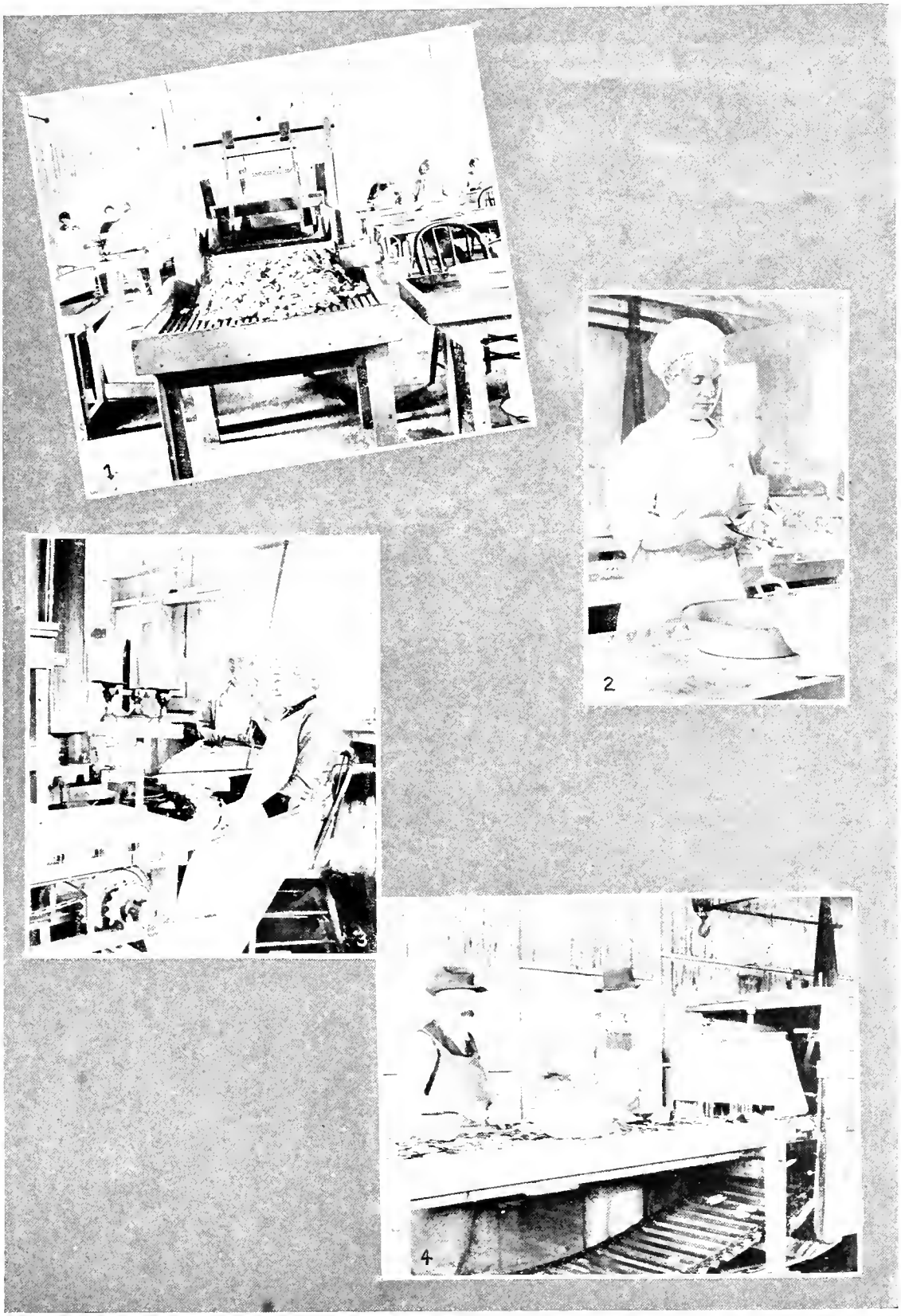
On the Pacific Coast the canning of razor clams has been brought to a high degree of perfection in certain plants through the development of special machinery for doing certain parts of the work.

Upon the arrival of the clams at these plants they are dumped into one end of a long rectangular box. In this is a wire rack which has a slight upward curve. This rack has successive steps, one a little higher than the other, and the whole rack is operated somewhat on the same principle as a rocker in a quartz stamp mill. In the center of the box is a tank of hot water, surmounted by a square box resting on the top of the main box. The hot water causes the clams to gape widely and the action of the rocker shakes the meats out and also advances the meats and shells step by step until they reach the opposite end. Here jets of cold water are played upon the meats in order to cool them rapidly; should they cool slowly they would become tough. The meats are picked off the frame and placed in large dish pans, while the shells pass on and drop onto the beach through an opening in the side of the building.

The pans of meats are then taken into another room where girls sitting in front of long zinc-covered tables dress the bivalves. Taking a clam in her left hand the girl splits it from tip to tip on one side with a medium-sized pair of scissors, causing it to lay wide open. Near the end of the siphon is a darkmass, composed principally of sand and dirt, which is then clipped off.

The meats are then placed in a cylindrical perforated washing machine, which revolves automatically half a turn both ways in a tank filled with water for the final washing. They are then taken to another set of operators who cut off the siphon and side walls of the body. The stomach is then slit open with a pair of scissors and cleaned out, after which it is put with the rest of the meat.

The meats are then dumped into a hopper, fitted with a plunger to force them down, and thence into a grinder, whence they emerge in a minced condition. The mass is then dumped into a square hopper, which automatically feeds the quantity desired into the can, which is brought under the mouth of the hopper on an endless belt. Should the mass in the hopper become dry and move sluggishly, the operator feeds a little clam nectar to it by means of a hose from a small tank running to the edge of the hopper. The operator also stirs up the mass occasionally with a wooden paddle. It is said that one bushel of razor clams in the shell will, when prepared for canning, fill 20 one-pound cans.



RAZOR CLAM CANNING.

1—Washing the Clams by Machinery; 2—Cleaning the Clams; 3—Adding Nectar to the Filled Cans; 4—Removing the Meats from the Shells.

As the filled cans pass by on the endless belt another operator adds the necessary clam nectar by means of a hose pipe fitted with a pair of nippers for the purpose of shutting off the flow. The belt upon which the cans travel slopes slightly toward the operator, thus facilitating the adding of the fluid.

The tops are then put on loosely, after which the cans pass into the exhaust box, where they remain about 8 minutes, temperature 210° F., and then pass out, when the top is sealed. They are then packed in coolers, these piled one on top of the other on a car, when the car is run into a retort, where they are cooked, 1-pound cans about 90 minutes at a temperature of 220° F., ½-pound cans 70 minutes at similar temperature.

As soon as the cooking is completed the steam is blown out and heavy sprays of cold water played on the cans so as to cool them rapidly; should they be allowed to cool slowly the meats will become tough. They are then taken out of the retort, cleaned in a lye bath, and are then ready for lacquering and labeling.

In the more primitive plants the clams are steamed in wooden vats and are washed and dressed in what are virtually enameled lavatory basins, arranged in rows, each with two separate faucets. The other operations are the same.

In one plant a rectangular box with three compartments is in use. The clams are placed in a box with sides and bottom of netting. This is lifted by a block and fall and let down into the first compartment, where the clams are washed in cold water. It is then lifted out of this and lowered into the second compartment, which has hot water, where the clams open themselves. The box is then put into the last compartment, which is filled with cold water in which the meats are cooled off.

The little-neck and butter clams, and several related species, are usually canned whole, although at times considerable quantities are canned minced.

Upon arrival from the beds a few of the canneries packing whole clams put the bivalves in a tank of water and throw cornmeal over them and allow them to remain here for 24 hours. During this period they pass all the food and other material in their stomachs when dug, and the cornmeal helps to clean and bleach the flesh.

The outsides of the shells are then thoroughly washed, after which they are placed in a receptacle so arranged that all the liquor in the shells may be saved. Steam is then turned on for 30 minutes, the receptacle having a temperature of 212° F. When taken out the shells are wide open, from which the meats can quickly and easily be removed, while the juice is transferred to another receptacle.

If the meats are to be canned whole the greater part of the siphon, which is quite tough, is cut off. In making minced clams the meats are run through a meat grinder, in which event the siphon can go in with the rest of the meat.

The meats, together with some of the liquor, are then packed hot into the cans, the tops sealed, and then the cans run into closed retort, where 1-pound cans are cooked 1 hour and 40 minutes at a pressure of 10 pounds, and a temperature of 240° F. A long cook is necessary in order to produce a tender product. Half-pound cans are usually cooked at the same temperature for about one hour. Should the meats be held until cold it will be necessary to run them through an exhaust box for about 10 minutes at a temperature of about 212° F.

Clam Nectar

The surplus liquor, or juice, also known as nectar, is packed separately, and after being put hot into the cans the latter are sealed, after which 1-pound cans are cooked for 1 hour at a pressure of 10 pounds and a temperature of 240° F. Should the liquor be

cold when put into the cans they should be exhausted about the same as the meats. Half pound cans are usually cooked at the same temperature but for a shorter time. The length of the cook for the latter can soon be determined by experiment.

Hard and Soft Clams

In canning the soft clam the siphon is cut off (there being no siphon, this is not necessary with the quahog), the thin skin or film covering removed, and the clams cleaned in the same manner as when prepared for the table. The meats are then placed in tin cans, holding from 6½ to 12 ounces (known in the trade as 1-pound and 2-pound cans), after which the cans are nearly filled with the liquid, diluted with either fresh, salt or sea water, and the covers put on. The cans are exhausted for 10 minutes at 212° F., the tops then sealed on, after which they are cooked at 240 F., 1-pound cans for 15 minutes and 2-pound cans for 20 minutes.

In packing quahog or hard clams the only difference in the treatment is to process 1-pound cans 20 minutes, 2-pound cans 25 minutes, and 3-pound cans 30 minutes.

A few quahogs are pickled, New York being the center of this trade. The clams are generally steamed in the shell, a basketful being placed in the steam box at a time, where they remain for 10 to 30 minutes, according to the time for which they are to be kept. On removal the clams and liquor are cooled separately, the latter being first strained and flavored with vinegar, lemon, mace, etc., and then combined and sealed up in suitable receptacles.

Clam Chowder

Considerable clam chowder is packed annually. The meats are prepared in the manner previously described. Owing to its more pronounced flavor the quahog is the most popular species for this purpose. Usually in preparing clam chowder it is found much cheaper to get together and prepare the necessary ingredients for a large than a small quantity. In preparing the chowder, to 2,500 quahog meats are added the following ingredients: 25 pounds bacon, 25 pounds potatoes, 7 pounds onions, 25 pounds tomatoes, ¼ pound finely chopped parsley, ⅛ pound thyme, 1 ounce sweet marjoram, 1 pound salt, ½ pound ground white pepper, and 15 gallon of water.

The clams should be washed in cold water, drained and chopped. Cut the potatoes and bacon in dice, and place the water, clams, bacon, onions, potatoes and tomatoes in kettle, bring to a boil and cook 10 minutes; then add other igredients: stir thoroughly and place in cans. The cans are then topped and processed, No. 3 cans for 80 minutes at 250° F.: for quarts, 50 minutes at 250° F.

Any quantity of clam chowder can be prepared at one time by correspondingly increasing or decreasing the quantities noted above.

Clam chowder is usually packed in No. 3 cans, though it is also put up in No. 1, No. 2 and No. 10 cans.

A condensed clam chowder is prepared in the same way as plain clam chowder. In preparing this only half the quantity of water is used. After all the ingredients are added and mixed, and the steam turned off, the liquid is drawn from the bottom of the kettle, the cans filled with the solid materials and covered with the liquid. They are then capped, tipped and processed. No. 1 cans 40 minutes at 250° F. When preparing this for the table additional milk or water can be added in the quantity most desirable.

Clam Extract

Of recent years it has been well established that clams, both hard and soft, form one of the most nourishing and easily assimilated of all foods, especially when the hard indigestible portions are eliminated. As a result clam juice or extract is now almost universally employed as a food for invalids or convalescents.

In preparing clam extract the uncooked clams are placed on open racks or gratings in a retort, which is air and steam-tight, and live steam is admitted for about 20 minutes. The heat causes the clam to open its shell, and the liquor drops into pans placed under the racks. The juice is then passed through a filter, and is then boiled to evaporate a part of the water and concentrate the extract, thus making a given quantity of it richer than it would otherwise be, the boiling preventing decomposition when the product is exposed to the air. The liquid is finally put, while hot or cold, into cans and hermetically sealed, the time of processing or cooking the cans so as to exclude the air and have it keep in any climate, varying as to whether the concentrated juice or extract is poured into the cans hot or cold. One-pound cans packed hot are usually processed for 1 hour at a temperature of 240° F. Half-pound cans should be processed for a little shorter time but at the same temperature. If packed cold the product should be exhausted about 10 minutes at a temperature of 212° F.

Amount of Meat in Can

The U. S. Food and Drugs Board in Food Inspection Decision No. 144 rules that in canned food products the can serves not only as a container but also as an index of the quantity of food therein, and should be as full of food as practicable for packing and processing. Where the addition of brine or water is necessary for proper preparation, the can should contain only sufficient liquid to fill the space between the meat and cover the product. Many canners of clams have asked the Board to rule regarding the weight of clams necessary to comply with Decision No. 144. As a result of investigations the Board states its opinion that cans which contain the weights of drained clam meat shown below will fulfill the requirements. These w ights are "cut out" weights, i.e., the weight of meat left in the can after all free liquor has been drained off.

Type of Can.	Diameter.	Height.	"Cut out" Weight of Clams.
No. 1 Regular or oyster	2 11/16 inches	4 inches	5 ounces
No. 1 Maine style	3 inches	4 7/16 inches	8 ounces
No. 2 Short or picnic	3 3/16 inches	4 inches	8 1/2 ounces
No. 2 Regular	3 3/16 inches	4 3/16 inches	10 ounces

When cans of other sizes are used, they should contain proportional weights of meat.

It should be remembered, the Board states, that a loss of weight almost invariably occurs when clams are processed, and due allowance should be made for this loss in weighing the clams into the can. It may be said that the investigations made in the Bureau indicate that the loss in weight in processing varies from about 5 to 15 per cent., the average loss being about 10 per cent. of the clams placed in the cans. The weights of drained clam meat should not fall below those given above, or, if a variation occurs, it should be as often above as below the weights specified.

SEA MUSSELS

Of the many neglected products of our saltwaters none can compare with the sea mussel in abundance, nutritiousness and palatability. The Atlantic species (*Mytilus edulis*) has a wide distribution, extending down our eastern coast to North Carolina,

while a closely related species (*M. californianus*) extends down the Pacific coast to San Francisco, Cal. It is extremely abundant in the shallow, sheltered bays along the coasts of New Jersey, Long Island, Rhode Island and Massachusetts on the Atlantic coast, and in the same class of bays in Oregon, Washington and Alaska on the Pacific coast. The mussel seems to grow equally well in shallow and deep water. The favorite habitat of the mollusk is where the water is slightly brackish, in shallow, protected bays and estuaries, on a bottom of mud rich in diatoms and covered more or less with stones or other solid objects to which it may attach by means of its byssal threads. The swift tideways of shallow inlets are also very good situations for the mussel. In these localities the animals thrive in enormous bodies. Other situations chosen by the mollusk are the piles and timbers of bridges, wharves, rocks and other objects.

Despite the fact that the mussel was a favorite article of food with the aborigines, it has been sadly neglected by our people. In a few sections—Puget Sound and San Francisco on the west coast, and New York on the east coast, mainly—it figures as an article of food. The mussel is as palatable as the oyster, much more nutritious and more digestible. It contains only half as much waste as the oyster, is more abundant, is more easily cultivated in that it requires less special conditions for growth, and it is adapted for making a greater variety of food preparations. Furthermore, it is in season for the table when the oyster is out of season.

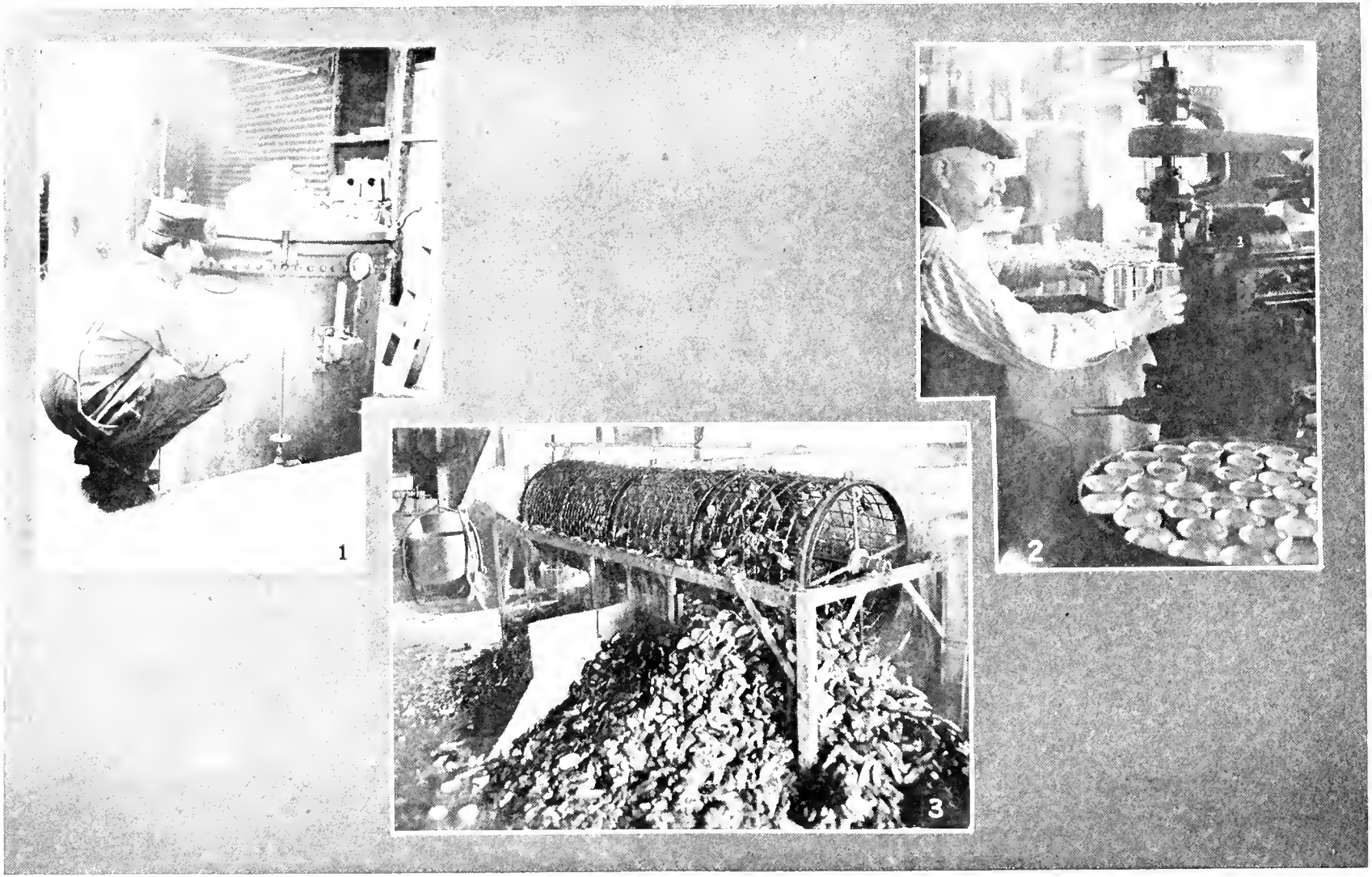
The only difficulty in the marketing or canning of mussels for food purposes is that they spoil quickly after being removed from the water. It is necessary to use them within twenty-four hours after they are collected or ptomaine poisoning may result. To insure one's self against illness from eating them, the mussels must be taken from water that is pure and subject to the constant circulation of tidal currents For the canner on the Pacific coast these conditions are easily complied with as the coast itself is not so much built up as on the Atlantic. On the latter coast, however, suitable sites are very abundant.

The sea mussel is of all shellfish particularly adapted for canning. Unlike the oyster it remains tender and retains its full flavor when subjected to the high temperatures necessary to prepare it in this way. It also does not shrivel up like the oyster when cooked, thus presenting a far more sightly appearance when canned than the latter.

There are three plants—one on the Atlantic and two on the Pacific—engaged in canning the mussel. The method in use in canning is either that devised by Dr. Irving A. Field in his experimental work prosecuted under the auspices of the U. S. Bureau of Fisheries, or slight modification of same. Dr. Field's method is as follows:

"The mussels when taken from the collecting boats are rapidly picked over by hand to eliminate any dead or unhealthy ones which may be present, as well as the coarse adhering debris. Then they are placed in a cleaning apparatus, such as shown in Fig. 2. It consists of a rectangular box 2x2x3 feet, which revolves on its long axis. The ends of the box are of solid yellow pine and are firmly held in place by 4 pair of braces 3 feet long, 2 inches wide and $1\frac{1}{2}$ inch thick. Three sides of the box are enclosed with $\frac{3}{4}$-inch mesh galvanized wire netting. The fourth side has a door 8 inches wide, running the length of the box. The door is clamped firmly in place by means of a lever, which is swung over it. The rest of the side is filled in with parallel strips of wood placed $1\frac{1}{2}$ inch apart. The projecting ends of the axis rest on the walls of a trough $1\frac{1}{2}$ feet deep, in which there is running sea water. A crank at one end serves as a means to rotate the cage.

"About one bushel of mussels is placed in this cleaning apparatus, which is set in rotation at the rate of 30 revolutions a minute for 15 minutes. The treatment cleans off from the shells all clinging sea weeds, sand and debris, besides breaking open the shells



THE CANNING OF SEA MUSSELS.

1—Cooking the Cans in a Retort; 2—Sealing the Tops on the Filled Cans; 3—Breaking Open the Clusters of Mussels.

of dead mussels and washing away the injurious substance contained within them. In the experimental work this method of cleaning mussels proved very effective. For cleaning on a commercial scale the device may easily be constructed on larger dimensions and operated by means of steam or water power.

"After this treatment the mussels are removed and rinsed off with clean water. They are placed in a chest and subjected to live steam for from 5 to 10 minutes, or until the shells begin to open. They are next emptied out into shallow pans to cool and the natural liquor which has escaped into the chest is preserved in a separate dish. As soon as they are cool enough to be handled the mussels are shucked and the horny "beard" removed, the meats and liquor being preserved in separate dishes.

"While the liquor taken from the steam chest and that taken from the mussels during the process of shucking is filtering through a fine-meshed cloth, the mussel meats are packed in glass jars or bottles. The filtered liquor is brought to a boil and two ounces of salt are added for each gallon. The jars containing the meats are then filled with the boiling liquid and sealed. To insure complete sterilization, the sealed jars are placed in a steam chest and subjected to 5 pounds pressure for 15 minutes. They are allowed to cool down slowly and when the temperature has fallen to about 100 degrees F. they are removed and set aside for future use."*

Aside from the small quantity now canned, pickling is the only form of preservation in use. As an article of trade they are known only to New York City and vicinity, one man supplying most of the demand. Dr. Field found the following an excellent method of pickling:

"After thoroughly washing the mussel shells in the cleaning apparatus already described, the mussels are placed in a steam chest for about 10 minutes, or until the shells have opened. They are then shucked, the liquor and meats being preserved in separate vessels. Care should be taken to see that the horny filament or "beard" is removed from the base of the foot. For each quart of natural liquor there is added 1 pint of vinegar, ½ ounce of allspice, ½ ounce of cinnamon, ¼ ounce of cloves, ¼ ounce of salt and 1 small red pepper. The mixture is allowed to simmer upon the stove for 15 minutes and is then poured over the meats. After standing about twenty-four hours the meats are removed from the spiced liquor and are neatly packed in bottles or fruit jars. The liquor, after being filtered through a fine-meshed cloth to remove the undissolved spices and sediment that is formed, is heated to boiling and poured over the meats until the jars are brimming full. The jars are sealed airtight and placed in a steam chest, where they are subjected to 5 pounds steam pressure for 15 minutes."*

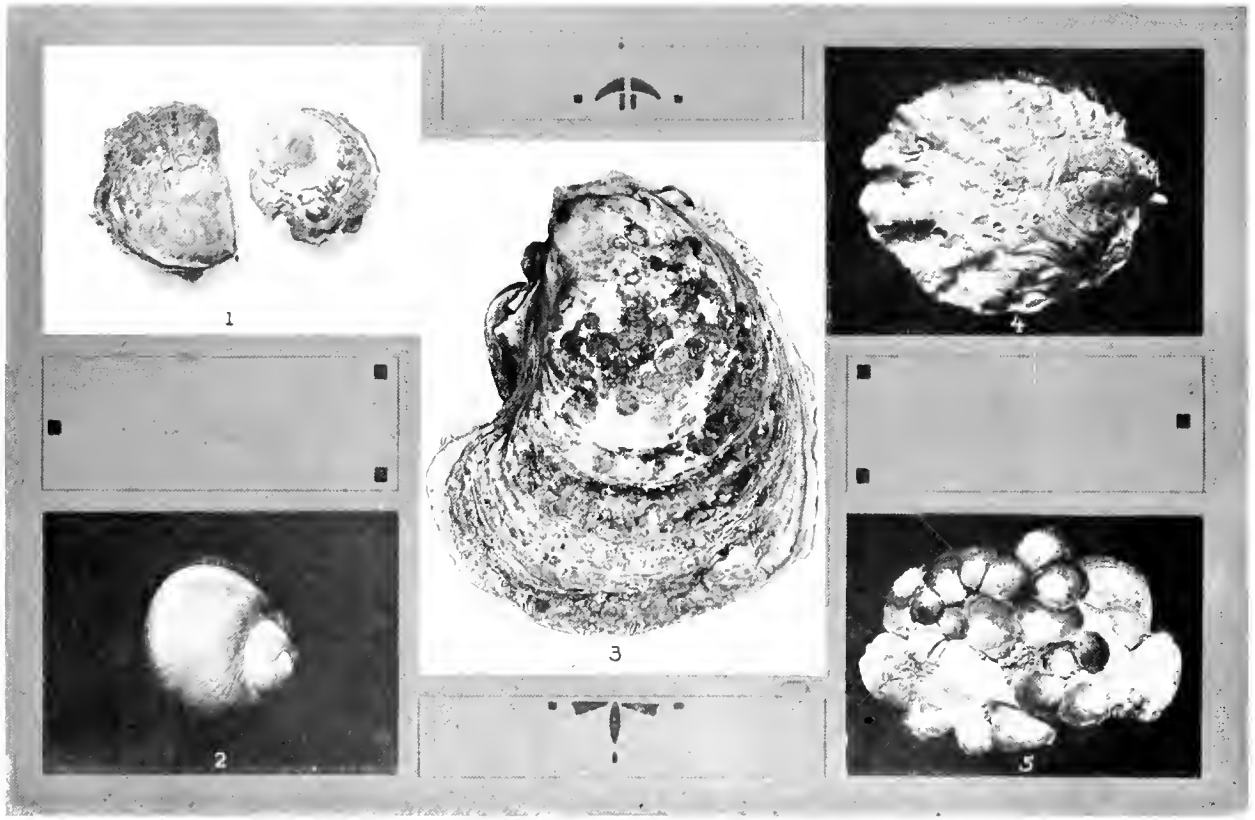
After this treatment they will remain in a good state of preservation for about two years. If the pickled mussels are desired for immediate consumption it is not necessary to seal them up; they may be kept a week or more in open tubs without deteriorating. If kept much longer than this they gradually turn dark and fall to pieces.

OYSTERS

The oyster industry is the most important prosecuted by the fishermen of this country. It is carried on in every coastal state in the Union except New Hampshire. There is but one species of oyster, *Ostrea virginica*, found upon the eastern coast of the United States. Upon the western coast there are two species which are of commercial importance, the native oyster *(Ostrea lurida)*, found in all three states, and the eastern oyster,

* "The Food Value of Sea Mussels," by Irving A. Field, Bull. U. S. Bureau of Fisheries, Vol. XXIX, 1909, pp. 111-13.

* Ibid, p. 114.



OYSTERS GROWN ON THE PACIFIC COAST AND THEIR ENEMIES

1—Native, or "Olympia," Oysters; 2—Sea Snail (*Polynices lewisii*), Which Destroys Many Oysters Annually; 3—Eastern Oyster Bred Near Nasel River, Willapa Harbor, Wash.; for Many Years it was Supposed the Eastern Oyster Would Not Breed on the Pacific Coast; 4—Japanese Oyster Introduced on Pacific Coast; 5—Cluster of Young Native Oysters.

which was first planted in San Francisco Bay about 1872, and since in other bays along the coast, its culture now forming the basis of a somewhat important industry. For some reason it generally does not propagate when transplanted to the Pacific coast, possibly due to the considerable difference in the temperature of the water on the two coasts, and the supply is kept up by the constant importation of new seed. A few years ago some beds of oysters which had grown from spat deposited by Eastern oysters were found in Willapa Harbor, Washington. Some of these were 4 and 5 years old. They were in such abundance that it is probable a hardy type has been evolved and it is possible that within a short period of time the present costly method of bringing the seed from eastern beds can be given up. The native oyster is much smaller than the eastern and has a light, thin shell. It occurs in greatest abundance in the state of Washington.

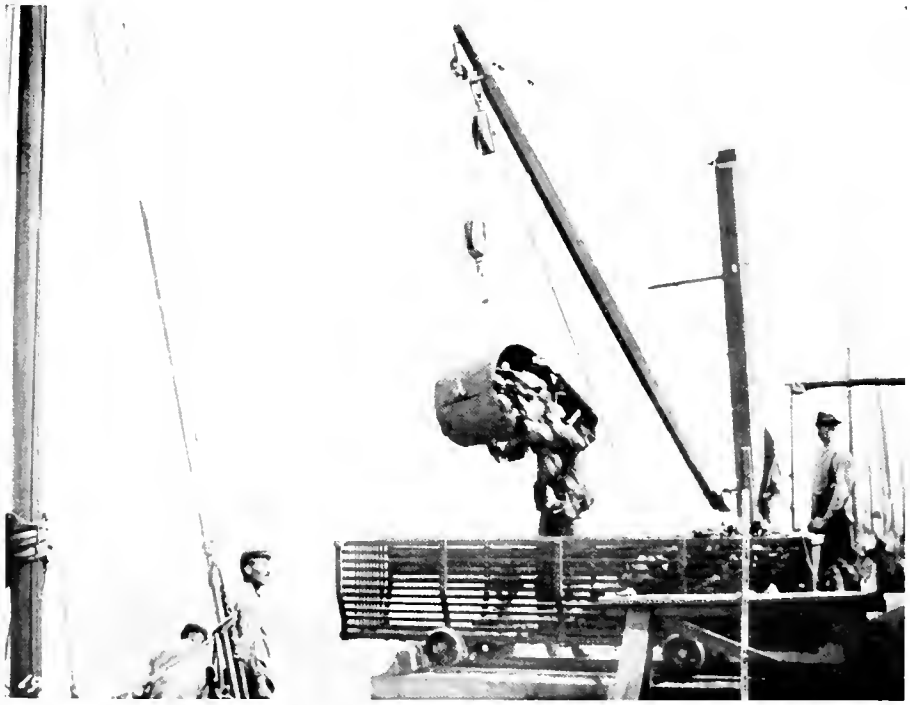
TONGING OYSTERS IN THE GULF OF MEXICO.

Tongs and dredges are practically the only forms of apparatus used in the Atlantic fisheries, the former being used mainly in shallow waters and the latter in deep waters. On the Pacific coast, where the oyster beds are in quite shallow water, most of them being exposed at low tide, the dredge is not used, short tongs, and sometimes rakes, being the principal apparatus used. Many are picked up by hand when the ground is bare.

When taken from the bottom oysters are usually quite muddy and have to be washed. On the steam dredgers this is usually done by hauling the load close to the surface of the water, then dropping it a short distance, a friction clutch on the winch permitting of this, then raised again and dropped, until the mud has been washed out. The tongers and dredgers who operate on the natural reefs have to cull the catch there, and while culling they clean the oysters.

When the oysters are brought in from the grounds they are first culled and sorted into the different grades that are required by the trade. For canning small oysters are generally employed, and as such are most abundant in the southern states, these have become almost the sole source of supply. For many years the business was most important in Maryland, but Mississippi now leads in this respect. These goods are generally marketed under the trade name of "Cove Oysters." Several reasons are given to account for the use of this name, the oldest being that the original "cove oysters" were found in coves on the west side of Chesapeake Bay, above the Potomac, and were famous for their size and quality. Mr. Hugh S. Orem states that its origin is far more prosaic and commonplace. "In those years (1865-70) 'Cove' Street, the identity of which is now entirely lost, was more an alley than a street, and ran east and west from the northernmost point of Baltimore's harbor, for the distance of three short blocks. Two 'oyster shops,' as they were then called, were located in one of these blocks, almost directly opposite. One was a shipper of oysters in the fresh, or raw state, the other a canner of hermetically sealed oysters. The canner used a label upon which was printed 'Fresh Chesapeake Oysters,' to which the 'raw' man demurred. Hence to differentiate between raw and cooked oysters, the term 'Cove Oysters' was decided upon. The name of a street supplied the title, *and not any cove or other place in the Chesapeake Bay.*"*

The cannery should be located along the waterfront so that the oyster vessels can come alongside the dock. When taken from the vessels the oysters are placed in cars of



DUMPING OYSTERS INTO CARS IN WHICH THEY ARE LATER STEAMED.

iron framework, 6 or 8 feet long, with capacity for about 20 bushels unshucked. These cars are run on a track into a steam-tight chest or box. At some canneries, before reaching the steam box they are stopped and two streams of water forced on top of the

* "Baltimore, Master of the Art of Canning," by Hugh S. Orem, in a History of the Canning Industry, Part II., The Canning Trade, Baltimore, Md., Jan. 19, 1914, Vol. 37, No. 21.

car for the purpose of washing the bivalves. The steam chest is a rectangular oak box, 15 to 20 feet long, lined with sheet iron, fitted with appliances for turning on steam to any desired pressure, and with a door at each end which shuts closely and is so packed with felt or some other material as to make the joint between the door and box as nearly steamtight as practicable.. As soon as the car is in the steam chest the latter is closed up, steam admitted until the gauge marks 10 pounds pressure, and maintained at this point 8 to 10 minutes; should there be numerous mussels clinging to the oyster shells from 3 to 5 minutes more will be required. The steam should then be exhausted, the doors opened by releasing the clamps nearest the hinges first, and those opposite last, just the reverse of that followed in closing it. The door at the other end is then opened and the car run into the shucking room, to be succeeded in the steam chest by another full car.

In the shucking room the cars are surrounded by the shuckers, each provided with a knife and a can arranged so as to hook to the upper bar of the iron framework of the car. The steaming causes the oyster shells to open more or less widely, and the meat is readily removed. In Maryland the shucking is done in a cup known legally as the "oyster-gallon cup," which holds 9 pints, wine measure. The shuckers generally roughly sort the meats into two sizes, primes and selects. Each bushel yields about 50 ounces of "solid meats."

After shucking the canners have been in the habit of washing the meats in cold water, but the U. S. Bureau of Chemistry now recommends as the most practical and effective method of cleaning shucked oysters, and removing any deleterious organisms they may have acquired during the process of shucking, is by mechanical agitation while washing them in a weak salt solution. In establishments which are not equipped with mechanical means for agitating the oysters during washing, it is advisable, according to the Bureau, to hose or spray them on the colander or skimmer and then to place the oysters in clean metal or enamel-lined tubs containing 1% salt solution (approximately 2 pounds and 1 ounce of salt to 25 gallons of water). The oysters should be thoroughly stirred with a paddle for 2 or 3 minutes, then lightly hosed or sprayed on the skimmer, carefully turned until they are dry, and then packed. The salt solution in the tubs should be frequently renewed.

After being washed the oysters are transferred to the fillers' table, during which operation the broken, torn and discolored oysters should be removed as they should not be canned.

(The oysters are generally used as soon as shucked, but if for any reason it is necessary to carry these oysters over night they should be covered over with cold water in which has been dissolved one per cent. bicarbonate of soda.)

Here the required amount of meats is weighed out and placed in the can, which is then filled up with hot brine, which is prepared in the proportion of $2\frac{1}{2}$ pounds of salt to $12\frac{1}{2}$ gallons of water. The can is then capped, exhausted 10 minutes at 212°, the tip hole closed, after which the cans are placed in a cylindrical basket or crate and lowered into a large cylindrical kettle, called the process kettle or retort, which is partly filled with water, which is heated by live steam, and here they are processed, No. 1 cans 12 to 14 minutes and No. 2 cans 14 to 17 minutes, according to the weight of meat, at a temperature of 240° F. After this they are placed, crate and all, in a vat of cold water, this serving the double purpose of arresting the operation of cooking by cooling them and of testing for leaks. When sufficiently cool to be handled the cans are transferred to another department, labeled and packed in cases for shipment.

METHOD OF DIKING OYSTER GROUND EMPLOYED ON PUGET SOUND, WASH.

At times it may be found necessary to can raw shucked oysters. These should first be well washed in cold water, given a bath in a 1 per cent. solution of bicarbonate of soda, then plunged in boiling water until the gills curl, after which they should be handled the same as steamed stock.

Some years ago pickled oysters were quite popular in and about New York city, but the demand is but slight nowadays. The oysters, with their liquor, are boiled in an open kettle for 5 to 30 minutes, according to the length of time it is intended to keep them. When boiled sufficiently the oysters and liquor are separated, the former spread on shelves to cool and the latter strained and mixed with sufficient vinegar to impart the flavor desired, to which may be added mace, lemon and other flavoring ingredients. When both the oysters and liquor are quite cool they are combined and sealed up in glass jars or other suitable receptacles. One serious objection to these oysters is that the boiling shrivels them up and causes them to present a rather unsightly appearance.

Oysters fried in crumbs have also been put in sealed cans, but the demand for these has never been of much importance.

According to the U. S. Bureau of Chemistry, Department of Agriculture, the following weights of drained meats taken from the can will meet with approval:

Size of Can.		Weight of Drained
Diameter.	Height.	Oysters "Cut Out"
2 1/16 inches	2 3/16 inches	3 ounces
2 1/16 inches	3 3/16 inches	4 ounces
2 1/16 inches	4 inches No. 1	5 ounces
3 3/16 inches	3 1/16 inches	8 ounces
3 3/16 inches	4 2/16 inches No. 2	10 ounces

The procedure adopted by the Bureau for draining in order to determine the "cut-out" or drained weight is as follows:

"Make a circular cut almost around the top of the can, push the cut top back into its original position, invert, and allow the contents to drain through the circular opening for *one minute*. Pour the liquid through a colander and return to the can any weigh-

able particles of solids which have been carried away by the liquid. The openings in the colander should not exceed 3-16 inch in diameter."

PERIWINKLES

The periwinkle, or whelk *(Littorina littorea)* as it is sometimes called, is found in abundance on our coasts. On the Atlantic *Buccinum undatum* is very common from Cape Cod northwards. In Bering Sea, and probably other parts of the Pacific coast, is found *Buccinum aleuticum*, also *Thais lamellosa*. In Europe related mollusks are a popular article of food, but so far our people have not seen fit to utilize them. The writer has frequently eaten them in Alaska and can testify to their tastefulness.

These mollusks could be canned, probably by using the same process as is common with clams. After steaming or boiling, they can be easily removed from the shell by means of a sharp-pointed tool.

PIDDOCKS

On the Atlantic coast, from Florida to Cape Hatteras, in colonies 10 inches to a foot deep, in sandy mud, also in wood and rocks, is found the piddock, or angels' wings *(Pholas costata)*. The white valves conform strikingly in outline, color and sculpture to the conventional representation of angels' wings. The shells are 7 to 8 inches long. The meats are eaten, pickled in vinegar, on the Normandy coast; they are also cooked with fine herbs and breadcrumbs. On this continent it is a staple article of food in the markets of Havana. If canned either whole or as chowder, they could doubtless be pro cessed somewhat as clams are.

SQUID

Squid are quite abundant in our waters, especially in the North Atlantic, where they are generally used as bait in the line and trawl fisheries. Many are also sold in San Francisco and Seattle markets. In Spain these mollusks are canned. As soon as landed they are thoroughly cleaned and washed, care being taken not to burst the little sack of black liquid they contain. The raw squid are then placed in layers in shallow tin cans similar in shape to those used for sardines, covered with olive oil and the top soldered on. The can is then cooked in boiling water for from 10 to 20 minutes, vented, tipped and processed for almost the same length of time.

NATICA

The moon-shell (Natica) is found in abundance on the Atlantic and Pacific coasts, where it is one of the worst enemies the clams have. On the Atlantic they are found from Maine to New Jersey, while on the Pacific their habitat is from California to Alaska; they are especially abundant in Puget Sound. The former has a diameter of 3 to 4½ inches, and the latter from 3 to 5 inches. The animal's foot is a flattened pad of flesh three times as long as the shell's diameter and half as wide as long, the general shape being similar to that of the bottom of an old-fashioned flat iron. A fleshy band on top of the foot folds back over the head, protecting it as the burrowing foot drags the body rapidly after it through the wet sand. When a clam is met down comes the hood from over the head, the radula it contains soon has a neat round hole drilled in the shell, through which the soft parts are extracted by the sucking mouth of the Natica.

It would be a very easy matter to can this mollusk at the clam canneries, as large numbers are caught by the clammers when digging clams. They could be steamed,

removed from the shell, the juice being saved, the meat minced and then packed in cans with the juice and processed the same as clams. The foot is tough when cooked, but this would not be noticeable when minced.

An idea has been prevalent in a few sections that the flesh of the natica is poisonous, but this is nonsensical, as the shells are found by thousands in the Indian kitchen middens on the Pacific coast, showing that they formed a considerable part of the food of the aborigines.

CRUSTACEANS

CRABS

THE crab fisheries are of great importance and are prosecuted in every coastal state except Maine and New Hampshire. In 1908 the crab fisheries of the United States produced 60,626,000 pounds, valued at $938,000 to the fishermen, nearly all of which were edible. In British Columbia in 1915 the fishermen caught 568,100 pounds, valued at $22,883.

The most important branch of the industry is that for blue crab (*Callinectes sapidus*). This crustacean is found in large numbers along the Middle and South Atlantic and Gulf coasts, but the fishery is centered mainly in Chesapeake Bay, which body of water fairly swarms with them, Maryland and Virginia in 1915 producing together 41,256,823 pounds of hard-shell blue crabs, valued at $578,129, and 9,086,445 pounds of soft-shell blue crabs, valued at $403,678.

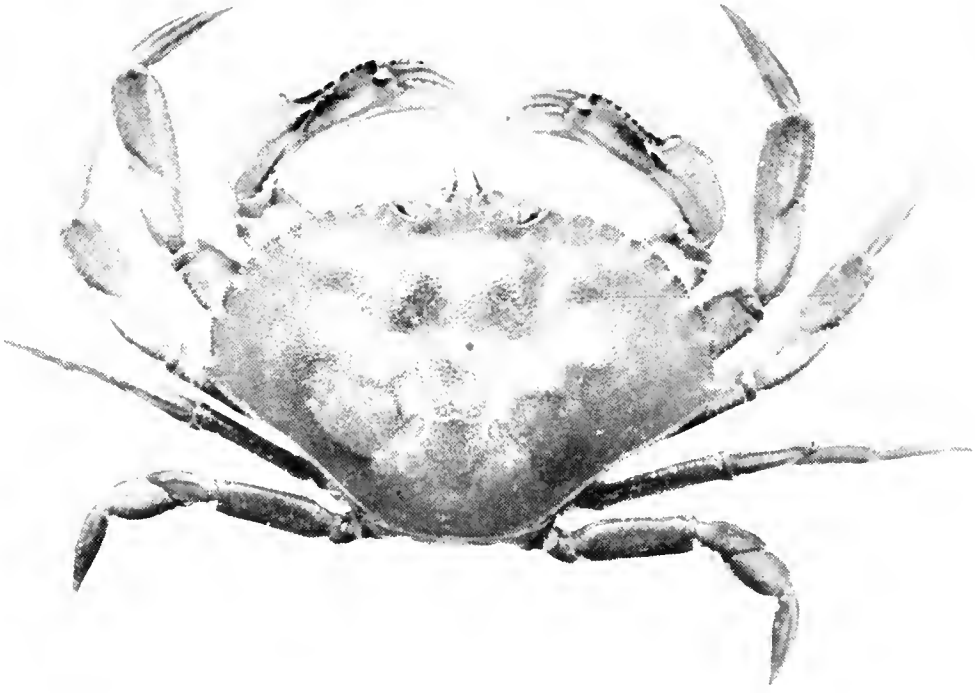
The favorite haunt of the blue crab is in the waters of some bay or at the mouth of a river, and it prefers shallow water with mud bottom and abundance of vegetation, to that of much depth. In summer it lives close to the shore; in the winter it moves into deeper water.

The bodies of all crustaceans are enclosed in a tough, unyielding shell, and in order that the animal may grow it is necessary for it to throw off, or moult, the old shell, which is replaced by a hardening of the surface of the body. In the blue crab the moulting period occupies about two or three days, and at this time, when it is what is called a "soft shell," it is much more valuable to the fishermen than when a "hard shell."

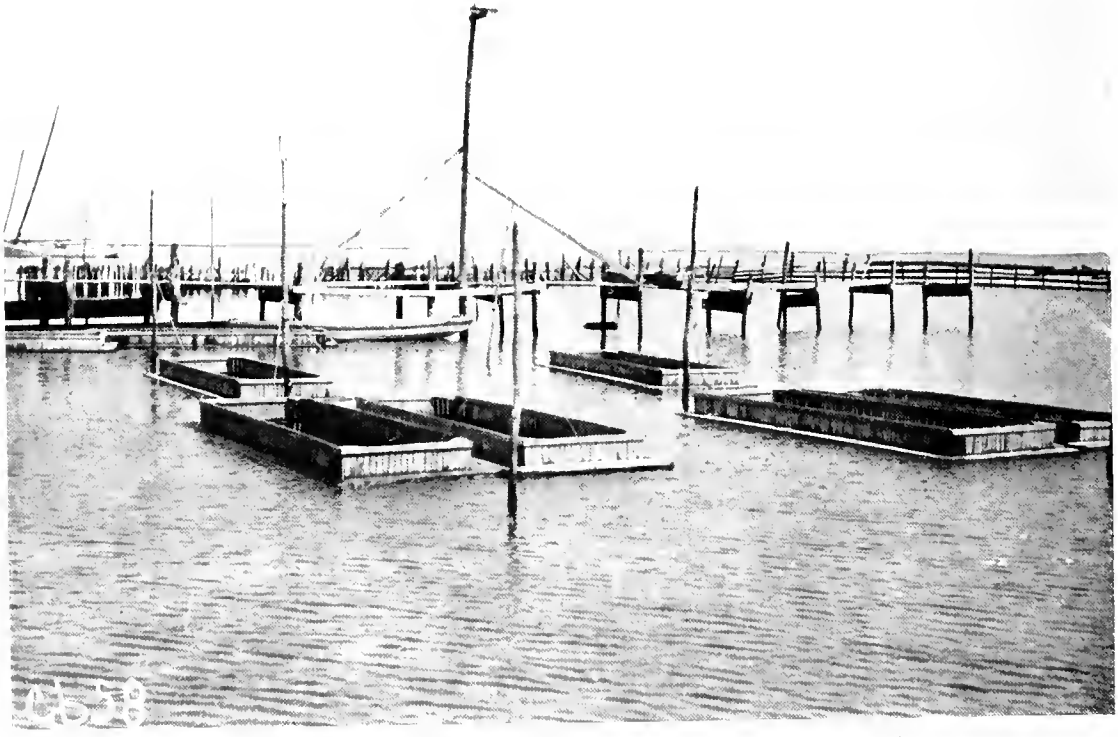
On Chesapeake Bay the crabbers classify a crab's life into six stages, as follows: First, the "hard crab," or one in its natural condition; second, a "snot," or one that has just entered the moulting stage; third, a "peeler," when the old shell has begun to break; fourth, a "buster," when the new shell can be seen; fifth, the "soft crab," when the old shell has been thrown off; sixth, a "paper shell," or "buckram," when the new shell is beginning to harden. Several hours after moulting the crab reaches the "paper shell" stage, and within three days the hardening process is completed. The warmer the water the more rapidly do the changes take place.

Blue-crabbing is usually divided into two branches, i.e., soft-crabbing and hard-crabbing. In Chesapeake Bay (the seasons are a little earlier or a little later in other sections, depending upon whether they are north or south of the bay) the soft-crab season extends from the first of May to the last of October, the season being at its height in June. Soft crabs are usually taken with scrapes, scoop nets and small seines. The scrapes are somewhat similar in design and method of operation to the oyster dredge, only much lighter.

The hard-crab fishery is carried on during the whole year in the more southerly range of the crustaceans, and during the open season in its more northerly range, the larger part of the catch being obtained during the summer months. They are usually taken with trot lines, varying in length from 200 to 1,000 yards. Some fishermen attach gangeons about 18 inches in length to the main line at intervals of 3 or 4 feet. Beef tripe and eels constitute the usual bait, although animal flesh of any sort will answer, and the lines are usually baited but once a week.



THE COMMON CRAB *(Cancer magister)* OF THE PACIFIC COAST.



FLOATS FOR HOLDING LIVE CRABS ON CHESAPEAKE BAY.

Every soft crabber has what is known as a float, a rectangular box approximately 10 or 15 feet long, 4 feet wide and 2 feet deep, the sides and ends being constructed of laths, and the bottom of 6-inch planks. Extending around the float on the outside, midway of its height, is a shelf about 7 inches wide, to prevent the float from sinking. The laths on the sides and ends are placed about one-fourth inch apart, to prevent minnows or other small enemies from getting at the crabs inside. These floats are used by the fishermen as a means of handling crabs that have entered upon the shedding process, but which have not yet reached the "peeler" or salable condition. The dealers use larger floats. The floats are generally enclosed by a fence to prevent their being washed away by strong winds. At intervals part of the floats are hauled out to dry as otherwise they would soon get waterlogged. Dealers employ men to watch their floats constantly and remove the crabs from the water immediately after the shedding process, to prevent the hardening of the shell.

In shipping the crabs are packed in shallow trays with wet seaweed or moss under and over them, with a layer of fine crushed ice on top. These trays are placed one on top of another in a box. The crabs can be kept alive from 60 to 70 hours after leaving the water.

Floats are not used by the hard crab fishermen, although the dealers use them. Live hard crabs are shipped in either barrels or boxes.

On the Pacific coast the principal edible crab is *Cancer magister*, which is found from Lower California to Unalaska, in shallow water on exposed sandy beaches or in sandy bays. This crab is often found buried in the sand, from which it issues promptly when food appears. Its food consists chiefly of small fish, shrimps, small crabs, small clams, etc. Old individuals attain a considerable size. Males measuring 9¼ inches across the back, and females (which are never as large) of 7½ inches in breadth, have been found. The writer weighed one in Eureka, Cal., in March, 1910, and it weighed just 4 pounds after boiling. At the time one of the dealers stated that some time before he had received one which weighed 6½ pounds.

Although the range of this crab is so great, it is not everywhere an important fishery. This is due sometimes to a scarcity of crabs and at other times to weather and water conditions being such as to prevent boats from frequenting the spots where the crabs are abundant. There are long stretches on the Pacific coast where harbors are very infrequent, and the surf such as to prevent any kind of fishing. At present the southernmost fishery of consequence is that at San Francisco. One of the most important, at present, is at Eureka, on Humboldt Bay. In Oregon they are fished at Coos Bay, Yaquina, etc., and about the mouth of the Columbia, and will be found abundant in some of the other bays when transportation facilities to consuming markets have been developed sufficiently to justify the fishermen in resorting to these places. An important fishery is carried on in and adjacent to Grays Harbor, Washington. On Puget Sound one of the earliest fisheries was at Dungeness, and in the Northwest it quite generally bears the name "Dungeness crab," but the fisheries about Anacortes and Neah Bay are now more important. In British Columbia the crab is extensively fished at Boundary Bay and at Prince Rupert, as well as locally at many other points. In time British Columbia will be an important producer of crabs.

This crab is exceedingly abundant in Alaska, but the fishery has never been developed to any extent, chiefly through the lack of an adequate market. They are especially abundant in Kasaan Bay, around Wrangell Narrows, in Icy Straits and in Prince William Sound (the last-named section is said to produce the largest crabs found on the

coast), and may be even more abundant elsewhere, although this has not been actually proven yet.

At present the legal size is 7 inches in California, 6½ inches in Washington and 6 inches in Oregon and British Columbia. Alaska has no regulations whatever affecting crabs. In Oregon and Washington no crabs can be legally taken during the months of July, August and September, while in California the closed season comprises August, September, October and the first half of November. British Columbia has no closed season.

Cancer magister moults just the same as its Atlantic relative, but the fishing here depends almost entirely on the use of bait, and as the crustacean is quite helpless when its shell is soft, and remains hidden until the hardening of the shell has progressed far enough to give it some protection, practically none of them are caught in the nets and pots while in this stage. On the Atlantic the crabs are taken with dip nets in very shallow water, or on a larger scale in deeper water with dredges, so that the fact that the crab is not active at this time does not materially affect the catch. The western crab is also much larger than the blue crab of the East, and for this reason could not be put to the same uses; it is also much more watery and of an inferior flavor during the soft-shell stage.

The fishing at San Francisco and Eureka is done in exposed waters off the harbors, and here, as well as at other localities where conditions are similar, the hoop net is exclusively used. The framework of the net comprises two iron rings, and these are connected by netting to form, when held by the line, a basin-shaped receptacle from which the crab cannot crawl, but which lies flat on the bottom when fishing, and at that time offers no hindrance to the crab in reaching the bait. Fifteen to twenty of these are set on one long line, ranged in line with the run of the tide, and left from half an hour to an hour, when the string is underrun until time to quit for the day, when all are taken into the boat and brought ashore, as otherwise the nets would be silted under.

In sheltered bays and sounds a gear closely resembling the eastern lobster pot is used. The pot may be entirely covered with netting, but it is more common to make the funnels of netting and cover the rest with chicken wire, all being tarred to protect them from salt water. They are usually left continuously in the water, being hauled as often as experience indicates is best.

Spears are frequently used in the more sheltered bays by those who are fishing for their own use.

In the Gulf of Alaska is found the spider crab. These crabs have a medium-sized body, with a great spread of long, slender legs, some specimens measuring six feet from tip to tip of legs. This is the species packed in Japan, but so far no commercial fishery for it has developed on this coast. They are mainly found at considerable depths and usually in open waters.

Handling the Crabs

The crabs are boiled in either an oblong tank or a large kettle, so equipped that steam may be forced in at the bottom in order to heat the water in which they are boiled. Upon arrival at the factory the crabs are thoroughly washed and then dumped into a tank about one-fourth filled with water in which has been dissolved one pound of bicarbonate of soda to each 25 pounds of crabs, and which has been brought to a jumping boil before the crabs are put in. The live crabs will bring down the temperature of the

water, and it should be brought to a boil once more, and the crabs cooked from 20 to 60 minutes. The larger the crab the longer the time required, and also the greater the number of crabs cooked at one time the longer the time required. The small blue crab requires the least time and the spider crab the longest. No attention should be paid to the foam, which should be let run over and go to waste. The liquid should be drawn off

AN ALASKAN CRAB BOILING PLANT.

after cooking, and the crabs then washed with cold water, after which they are dumped onto the picking tables, where the pickers remove the shells and strip the meat from the claws, legs and body with specially shaped instruments, which should be kept in a bright, clean condition. In a few factories the meat is removed by centrifugal force or by compressed air. The latter methods, which are of recent origin, are effective and save much labor. In the former method the shell and claw are cut across to expose the tissue and a quantity so prepared is placed in a centrifugal drum. The latter is made to spin at a high speed and all the meat is extracted. The compressed air method consists of an air compressor and a storage tank, with pipes leading to a nozzle. The shell is held in front of the nozzle, the air is turned on and the meat blown out. Either method is far superior in every way to hand picking.

The meat is then washed in cold 1% brine (one pound of salt to 12½ gallons of water), drained, slightly pressed to drive out what water may have been absorbed in washing, packed in cans with ⅛ ounce of salt in ½-pound can, the top put on, leaving tip hole open, or else the top put on loosely, and exhausted at 212° F., No. 1 cans 8 minutes, No. 2 cans 10 minutes. The tip hole should then be closed or the loose top sealed tight, and the cans taken to the retort, where they are processed, No. 1 cans 20

minutes at 240°, then 10 minutes at 250° F.; No. 2 cans, 35 minutes at 240°, then 15 minutes at 250° F. Five minutes should be allowed for bringing up the temperature of the retort to the proper point.

Some heat No. 1 cans for 30 minutes in boiling water, then vent and tip them, after which they are processed for 60 minutes at 240° F.

In some plants the crabs are placed in open slat-work cars and these rolled into a steam box, where they are cooked from 20 to 40 minutes, the time varying at different places, and according to the number cooked. It is claimed by some packers that more water remains in the meat after boiling than after steaming.

As soon as the processing time is over the retort is blown off, and, without opening it, a stream of cold water is introduced through a pipe entering at the top of the retort, in this manner cooling the cans without direct exposure to the air. The meat will darken if the cans are taken out of the retort before cooling.

The Japanese, who can large quantities of crab meat, process about as follows:

When ordinary kettles, with water, are used, the cans are first heated for one hour at 212° F. The cans are then taken out, vented, tipped and cooked again for 1 hour and 30 minutes at 212° F. In case steam heat is used, the heating must first cover 40 minutes at a pressure of 3 to 5 pounds of steam (222° to 228° F.). The cans are then removed, vented, tipped and put back for a final processing for 1 hour and 20 minutes at 4 pounds pressure of steam (225° F.). The vent holes are made as small as possible, and after sterilization is finished the cans are immediately placed in cold water and cooled.

Care should be exercised to see that the water in which the crabs are cooked is free from sulphur or iron.

Cans enameled or lacquered on the inside, or plain cans lined with parchment paper, are used in packing crabs, as the direct contact of the meat with the tin frequently causes the former to turn dark.

The meat is usually packed in two grades, the large clear white meat and the mixture of small bits and of dark meat. The meat from 12 blue crabs are generally required to fill each 1-pound can.

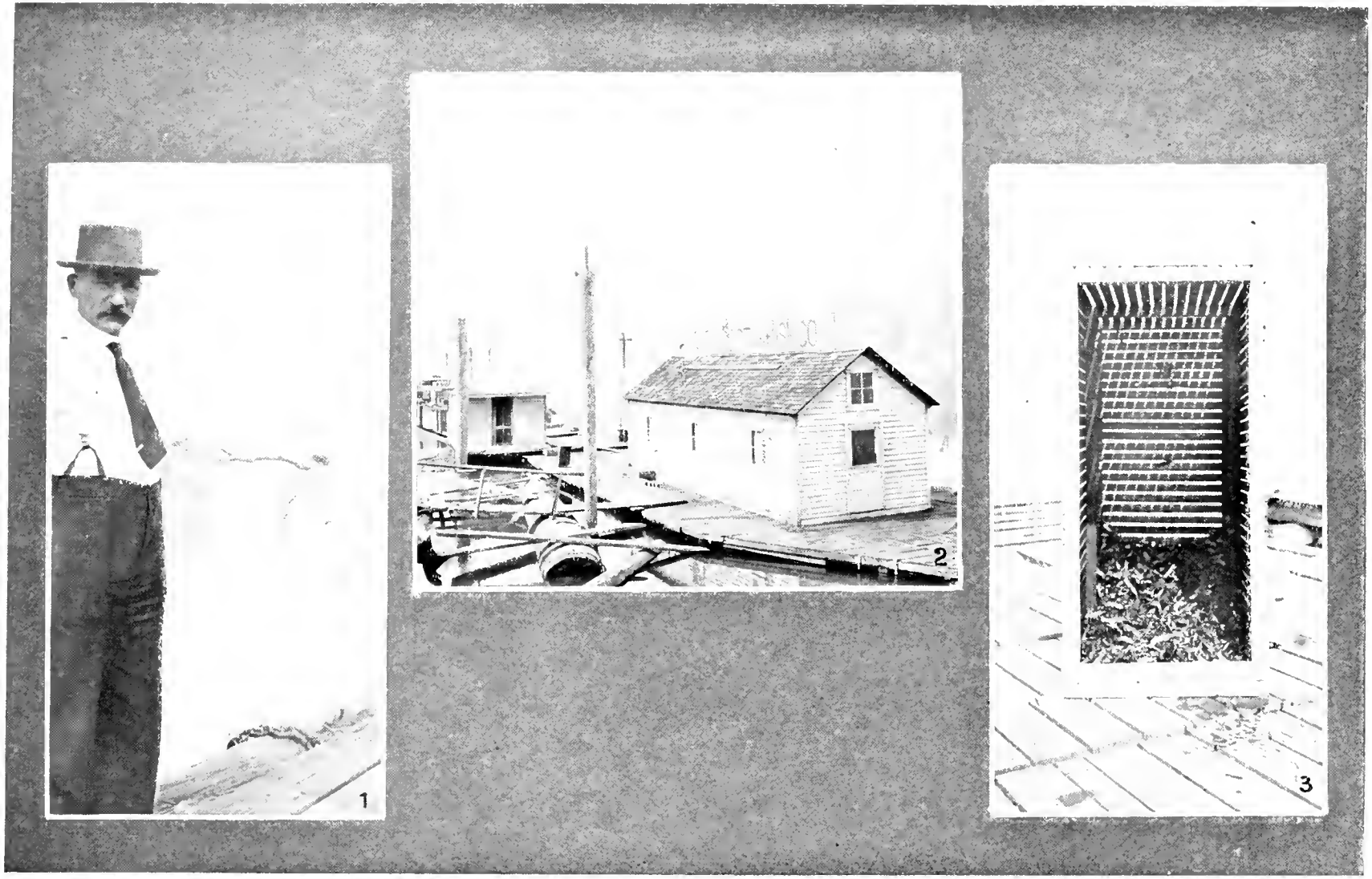
Canned Soft-Shell Crabs

A considerable number of soft-shell blue crabs are put up in Virginia and Maryland in hermetically sealed cans. The live crabs are first cleaned and prepared, then placed in wire baskets and cooked the same as the hard crabs. They are then packed in 1 and 2-pound cans. After the crabs are in the cans they are filled with hot 3% brine, the top crimped on, tipped, and then processed the same as hard crab meat.

Another method is to cook the crabs in boiling oil or lard for 5 minutes, the kettle being provided with an extension top so that the oil will not overflow. They are then packed in the cans with a small quantity of the hot lard or oil, the top crimped on, tipped and processed the same as hard crabs.

Canned Whole Crabs

Several Mississippi canneries pack hard blue crabs whole in 1 and 2-pound cans, while a few years ago a British Columbia cannery packed *Cancer magister* whole in 1½-pound flat cans. The entire crab, body and claws, was packed. The crabs had been cooked first and were put hot into the cans, which were then sealed up.



CRAWFISH OPERATIONS ON WILLAMETTE RIVER, OREGON.

1—Pot Used for Catching Crawfish; 2—Plant of Portland Crawfish Co., near Portland, Ore.; 3—Live Box for Holding Crawfish.

Canned Deviled Crab Meat

When picking crabs the meat is divided into three classes—"flakes," "ordinary" and "fat meat"; the flakes are considered much superior to the others because they are whiter and firmer. They are taken mostly from the "hip" of the crab, and are used principally in preparing deviled crabs by those who make them. Any portion can, however, be used for this purpose.

Each packer has his own special recipe, and, while a recipe is given below, the intending canner can use it or substitute another for it, or add anything to the one given, as it suits his own particular desires. In any event it will be well for the packer to try out several sample lots first in order to make sure he has obtained the right combination. The shell of a blue crab will hold the meat from two crabs. In shipping deviled crab the packer also ships enough empty shells for use in holding the meat when ready for consumption.

One pound of butter should be placed in a suitable kettle and melted, after which one pound of flour is added and the whole mixed intimately. One gallon of fresh milk is added, and the whole brought to a thorough boil while stirring constantly, when 2 ounces of chopped parsley, 2 ounces of onions minced finely, ½ ounce of ground white pepper, ½ ounce of ground red pepper and 4 ounces of salt are added; then enough crab meat added to make a mass of the proper consistency to fill the crab shells. The mixture is packed in cans while hot, capped and processed, No. 1 cans at 240° F. for about 40 minutes.

FRESHWATER CRAWFISH

The crawfish, or crayfish, is found in many of the freshwater streams of this country, though it is in but few states that they give rise to a commercial fishery, although in many states they are taken in small quantities for home consumption. They are especially abundant in Oregon, Washington, Wisconsin, Missouri and Louisiana, where they form an important article of commerce in each. The species found on the Pacific slope belong to the genera *Astacus*, while those found in the Mississippi Valley belong to the genera *Cambarus*. In general appearance the crawfish resembles the lobster, minus its cutting claws. They vary much in size in different sections of the country; in Oregon they average 3 pounds to the dozen.

As an article of diet the crawfish is becoming more popular as it becomes better known. At the present time the chief markets for its sale are San Francisco, Portland, Oregon; New York city and New Orleans. Foreigners, especially Frenchmen, are the principal consumers. In the East the crawfish is used principally by hotels and restaurants for making soups and bisque of crawfish, and for garnishing fish dishes and lobster salads. On the Pacific coast, however, they are prepared and eaten in the same manner as the lobster. Many are packed alive in boxes and shipped to various markets.

The crawfish are captured usually by means of small circular pots, similar to those used in catching eels, set on trawls, and made usually of wire netting. After being caught they are usually held in floats, divided by lattice work into compartments, until needed for shipment. In a few places baited dip nets are used.

Canned Whole

A bouillon should be prepared as follows: Water, 2 gallons; white wine, 2 gallons; cloves, 20; onions, in slices, 12; carrots, in slices, 10; cloves of garlic, 6; pepper to taste; salt, about 2 ounces; 2 bunches of parsley and a little thyme. Boil slowly for one hour,

replacing, at that time, with hot water the amount lost by evaporation. Before using the crawfishes they should be taken in the hand and the wing, which is in the middle of the tail, torn off, which will at the same time pull out a little black intestine which is very bitter. The live crawfish should then be thrown into the bouillon and boiled one or two minutes, never more. They should then be put in jars or cans, the former preferred, which should be filled up with the strained bouillon and processed in plain boiling water, 1-pounds, 1 hour; 2-pounds, 1½ hours.

Some packers operate with retorts and process at 220° F., 1-pound, 35 minutes; 2-pound, 50 minutes.

Canned Tails

The crawfish are thrown alive into bouillon same as described above, and boiled 2 minutes. They are then shelled, which operation removes the intestines. The meats are then packed tightly in glass jars, covered with the hot strained bouillon in which they have cooked, sealed and processed in boiling water, ½-pounds, 20 minutes; 1-pounds, 30 minutes. They should be allowed to cool off for 15 minutes before taking out of the processing bath.

Bisque of Crawfish

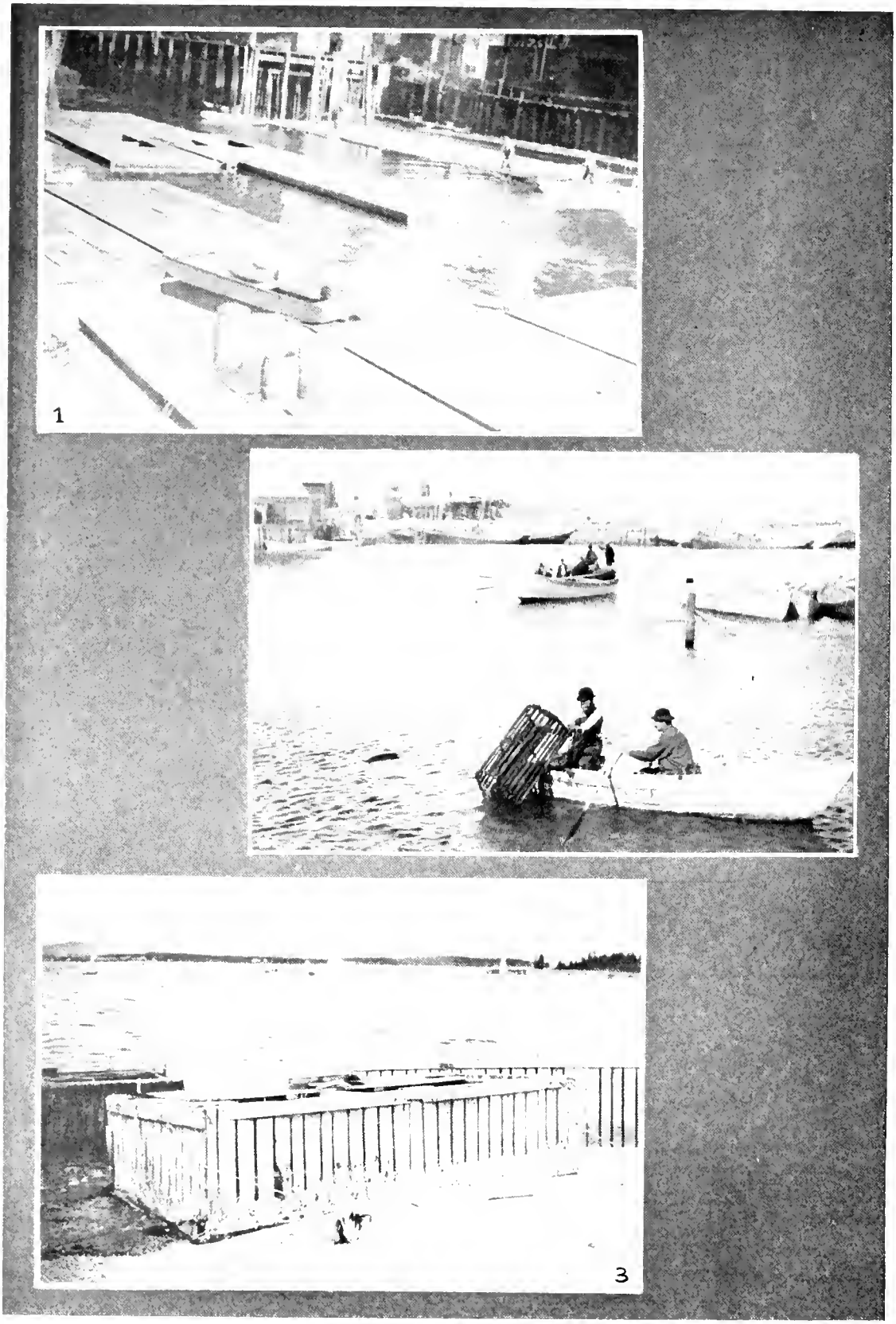
Boil the live crawfish in water 2 parts and white wine 1 part, the quantity being just sufficient to cover them, and flavored with a bunch of parsley, thyme and bay leaves and a few small onions. When cooked remove the crawfish and add in the kettle the same quantity of meat bouillon (made from 3 pounds of veal boiled slowly in as much water as will cover it, till the meat is reduced to shreds); it must then be well strained as it contains water in which the crawfish have boiled. To each quart of this mixed bouillon add 4 ounces of ordinary rice and boil slowly for ½ hour. During this time crush into a paste the crawfish meat, shell and all, then pass both the bouillon with rice and the crushed crawfish through a hair sieve. Put back in the kettle, incorporate 5 ounces of butter for each quart of the soup, spice with cayenne pepper. Can hot and process at 230° F., 1-pound, 50 minutes; 2-pound, 60 minutes.

LOBSTER

The American lobster (*Homarus americanus*) is found only on the shores of the North Atlantic, and on this continent its extreme range is from the southerly coast of North Carolina to Labrador. Its commercial range is much more restricted, however, as the southernmost point at which a commercial fishery is maintained is at Lewes, Delaware. It is most abundant in the eastern part of Maine and in the Canadian provinces.

This is the most valuable crustacean fishery prosecuted in the United States and Canada. In 1913 the lobster fishery of the United States produced 8,832,017 lobsters, weighing 12,067,017 pounds, valued at $2,394,822. Of this catch Maine produced 5,157,047 lobsters; New Hampshire 261,081; Massachusetts 1,197,805; Rhode Island 1,044,308; Connecticut 575,231; New York 348,550; New Jersey 227,776, and Delaware 20,480. In Canada, in 1916-17, 48,089,800 pounds of lobsters, valued at $3,476,652, were marketed. Of these New Brunswick produced 9,945,500 pounds; Prince Edward Island 11,128,900 pounds; Nova Scotia 24,140,000 pounds, and Quebec 2,875,400 pounds. In addition Newfoundland fishermen also caught and marketed in 1914 2,541,269 lobsters.

The pot, either square or half-cylindrical in shape, covered with wire or net, with a tunnel entrance, is almost universally employed in catching the crustaceans. These are generally set on trawls or long lines. In order to keep the animals alive they are placed



THE LOBSTER FISHERIES OF THE ATLANTIC COAST.

1—Dealers' Floats for Holding Live Lobsters, Portland, Maine; 2—Fisherman Emptying Lobster Pot; 3—Fisherman's Floats for Holding Live Lobsters.

in live boxes moored close inshore, or are placed in large pounds formed by fencing the narrow mouth of some small bay or cove, or by enclosing a favorable spot with a fence.

No lobsters have been canned in the United States since 1895, the fixing in Maine of a 10½-inch minimum limit as to the size of lobsters to be taken having made it unprofitable. Some of the plants were moved to the Canadian maritime provinces and, together with local plants, have been operated there ever since.

In canning, the lobsters, which should always be alive at the initial stage, are first boiled. A very few packers first kill the lobster by cutting it at the joint where the tail and body shell come together. The boilers in use are generally rectangular wooden tanks or vats lined with zinc and furnished with a cover. Heat is applied by the introduction of steam through a series of perforated pipes arranged in the bottom of the tank. The lobsters are placed in an iron framework basket of rather slender bars, which fits loosely in the receptacle, and this is lowered into the tank and raised again by means of a small derrick placed over it. When the water, in which about 3% of salt has been dissolved, is at a jumping boil the basket containing the lobsters is lowered into the tank and they are cooked for 30 minutes. The basket is then lifted out and the crustaceans cooled in cold water in which about 6% of salt has been placed.

Some packers plunge the lobsters into rapidly boiling water containing a 3% solution of bicarbonate of soda, and cook 15 minutes. The water is then drawn off and the lobsters covered with cold water acidulated with enough vinegar to neutralize the soda remaining in the lobsters, and cooked 15 minutes, after which they are chilled in cold salt water as in the first method.

Some packers boil the lobsters in fresh water and cool them in 18 per cent. salt brine.

A very few canneries have used steam for cooking the lobsters, instead of boiling them in water, the cooking time being about 35 minutes. Some canners claim, however, that in this method the meat becomes too dry.

As soon as cool enough to handle the pickers twist off the claws and tail, split the tail lengthwise underneath into halves and remove the intestines. The body shell is then opened and the liver and coral taken out, after which the body is taken from the shell and the stomach removed. The claws are then cracked and the meat removed in as large pieces as possible from these and the body. A small proportion of salt, to taste, is then mixed with the prepared meat, and the whole is packed solidly in No. 1 cans, dividing the claw meat and larger pieces of the body as equally as possible. The sweet-bread, which has been taken from the bodies, is generally put at the top of the can.

Instead of putting salt in the cans, a few packers cover the meat with a little salt brine, which can be flavored by boiling ½ hour with pepper, bay leaves and cloves.

As the meat of the lobster contains considerable phosphorus, which attacks and corrodes the tin coating of the can, causing the meat to turn black and giving it an unpleasant taste, it is necessary to line the cans—top, bottom and sides—with parchment paper to prevent the contact of the meat with the cans.

The cans are then topped and exhausted in a steam box until contents of cans show a temperature of 150° to 160°. The cans are then vented and tipped and processed one hour at 250° F., after which they are cooled in cold water. While hot the cans must be handled very gently in order to avoid "matting" or mushing up of the contents.

The lobster can be packed in glass jars, when they should be processed two hours in boiling water.

SPINY LOBSTER

The spiny lobster or crawfish (*Panulirus interruptus*) is found on the coast of California from Monterey to San Diego, and southward along the Mexican coast, and also along the Gulf coast of Florida, mainly around Key West. In characteristics and habits it is very similar to the eastern lobster (*Homarus americanus*); it is very much more active, however. It attains a total length of about 14 inches, and an average-sized individual weighs from 2½ to 3½ pounds. They are caught mostly in pots, although in Florida grains, or spears, take a few. In 1917 659,318 pounds were marketed in California, the greater portion of these coming from Mexican waters. The latest data for Florida is for the year 1908, and shows a catch of 53,000 pounds.

On the California coast this crustacean is canned in small quantities, the process employed being similar to that followed with the lobster.

The U. S. Bureau of Chemistry (Service and Regulatory Announcements No. 102), says: "It is the opinion of the Bureau that the term 'lobster,' either unqualified or when accompanied by a geographical name such as 'Cape' or 'Pacific,' can not properly be applied to this product. It may be labeled as 'spiny lobster' or 'rock lobster,' but in this case the qualifying words should be given in direct connection with the word 'lobster' and in type of equal size and prominence. The term 'lobster,' without qualification, is applicable only to the true lobster (*Homarus*). Labels showing pictures of the true lobster on canned crawfish are also regarded as false and misleading."

SHRIMP AND PRAWN

The shrimp is a decapod crustacean found in varying abundance on all our coasts and in many inland waters. The usual length of the animal is about 2 inches, but some attain a larger size. The prawn is closely related to the shrimp, which it resembles greatly, but attains to a much larger size, specimens 7 inches long being not uncommon in certain sections. The latter form the bulk of the canned product, the name shrimp being applied to all.

Owing to its generally small size the shrimp fisheries have never attained to much prominence, in most states the product being used mainly for food locally or as bait in other fisheries. In our southern states, however, where the prawns and larger shrimps abound, important commercial fisheries are prosecuted, mainly in the states of Louisiana, Florida, Georgia, Mississippi, Texas and North and South Carolina. Some few years ago California produced large quantities, but its catch has been steadily decreasing since 1899, due largely to the destructive methods of fishing practised for many years by Chinese fishermen. The business is of considerable importance in Puget Sound, in Washington. It is probable that Alaska will eventually be a heavy producer of these crustaceans when its resources have been more thoroughly explored. At present the most important centers of the fishery are on the Gulf coast of Mississippi, Louisiana and Texas, the northeast coast of Florida, San Francisco Bay and vicinity in California, and Puget Sound in Washington.

The crustaceans can be caught in our more southern waters every month in the year, but the principal fishing is generally carried on during the last half of March, and in April, May, August, September and October, when they are present in greatest abundance. Shrimp proper are quite abundant in the lower Mississippi River and quite important fisheries are carried on during the summer months in the states of Tennessee, Arkansas, Mississippi and Louisiana. In San Francisco Bay the fishery was formerly prosecuted throughout the greater part of the year, but at present there is a closed season of four months—May, June, July and August. On Puget Sound shrimp are found mainly

in Hoods Canal and around Fidalgo and Orcas Islands. While fishing is carried on here during the greater part of the year, it is most productive from September to May 1st.

On the Gulf coast and also on the northeast coast of Florida the haul seine, made with a bag in the center, is the principal apparatus used, although cast nets are used by a number of the fishermen. The bag net has recently been introduced on the Gulf coast. In the lower Mississippi River circular traps made of cane, with a small opening at one end, are used. Barrels, fitted with a net top with opening in the center, and sunk to the bottom by means of weights, are also used. In San Francisco Bay the Chinese use bag nets. This is a great cone-shaped sack or bag, about 40 feet long from mouth to apex, 24 feet wide at the mouth, and 4 feet wide at the bottom or point of the cone, which, when set, is tied up with a puckering string. A number of these nets are attached to a bottom line set across the current in channels with the mouths directed toward the current. On Puget Sound they are caught by means of beam trawls or dredges in depths from 10 to 70 fathoms. These consist of a frame about 3 feet wide and 12 to 20 feet long, made out of 1½ inch pipe, to which is fastened a net or bag about 12 to 15 feet long, and usually tapering toward the end. The frame is placed on broad runners and the whole contrivance is lowered over the stern of the steamer while it is under a slow bell, and towed along the bottom by means of a cable. After being hauled for from 20 to 40 minutes the net is hauled in by means of a steam winch and the contents dumped on the deck, where it is sorted over.

In our southern waters it is essential that the shrimp from the time they are caught be kept cold by means of ice, as otherwise they will soften quickly. This is especially important when the crustaceans are moulting, because then they are soft, easily broken in handling and more subject to decomposition. As soon as landed, or earlier, if possible, the shrimp are culled; all soft, damaged or small shrimp should be thrown out (some of these can be used for other purposes), and the slime and dirt removed by thoroughly washing with water. If not to go immediately into the cooker the shrimp should be packed in cracked ice or placed in a refrigerator. The use of ice makes the "peeling" of the shrimps easier.

The head and shells of all shrimps are removed for canning, and this is known as "peeling." The head and thorax break from the heavy tail with ease and a slight squeeze will separate the shell from the fleshy portion. The meats are then thoroughly washed in two or more changes of water and are then ready for "blanching." The blanching consists in boiling the shrimp in salt water, about one pound of salt being used to each gallon of water. The meats are usually placed in a wire basket and this suspended in the boiling brine in a kettle. The time of the blanch is usually about four minutes for the wet pack and five minutes for the dry pack. When removed from the shell the meats are white or slightly gray in color; the boiling process causes them to become bright pink or red.

The meats are then spread thinly on wire-meshed trays and exposed to a free circulation of air, which soon results in their proper cooling. As soon as cooled the meats are filled into cans by hand, each can being weighed. The cans are of two sizes, No. 1 or No. 1½, holding about 4½ and 8 ounces respectively. No attempt is made to grade the meat.

Canned shrimp are put up in what are known as dry and wet packs. In the former no liquid is added, while in the wet pack brine is used. The wet pack is the favorite product, as it is claimed to have more of the original or natural flavor than the dry; the latter also exudes an unavoidable odor. While this odor is sometimes quite strong when the can is first opened, it soon evaporates and the consumer will find the meat sweet and good.

The cans are capped and then processed in steam-tight retorts. In the case of wet pack they are processed at 240° F., No. 1 cans for 11 minutes and No. 1½ cans for 12 minutes. The process for dry pack is 60 minutes at 240° F. or 4 hours at 212° F. for No. 1 cans; and 75 minutes at 240° F. or 4 hours at 212° F. for No. 1½ cans. Great care must be exercised in handling canned shrimp until the cans are thoroughly chilled, as if given rough treatment while hot the meats will "mush."

When the weight of meats are in the cans they do not look filled. The experience of packers has shown, however, that close filling causes matting of the shrimp and an unsightly appearance. A barrel of good shrimp will pack 190 No. 1 cans or 100 cans of No. 1½.

Shrimp are difficult to keep and great care must be exercised at all stages. It was early discovered that when put up in the ordinary tin can the meats, which apparently contain a chemical substance of a corrosive nature, would blacken in a short time and attack the tin, making minute holes. Mr. G. W. Dunbar, one of the earliest packers, discovered that lining the inside of the can would prevent the discoloring of the meats. He inserted a sack in the can and put the meats in this and thus prevented them from coming in direct contact with the tin. Later a thin veneering of wood, corn husks, parchment paper, asphaltum or enamels were used to accomplish this purpose. Parchment paper is almost exclusively in use now.

In the wet pack method the brine used is said to neutralize the action of the acid, and lining material is generally not in use in this method.

Large quantities of shrimp are also put up in 1, 2, 3, 4 and 5-gallon cans, hermetically sealed, but not processed, as are the other cans.

In cooking these it is necessary to have brines of the proper strength. The strength of these will depend on the relative amounts of shrimp and brine used, the time allowed for cooking, and the degree of saltiness desired. Each packer, by experiment, can determine readily the strength of brine and length of cooking which will yield the results he desires. In general, the brine should contain not less than 10 per cent. by weight of salt and not more than 25 per cent. There should be at least 4 gallons of brine for each 10 pounds of shrimp.

Most of the handlers cook the shrimp in rectangular iron or wooden tanks or kettles with coils of steam pipes near the bottom, which system permits of exact control of temperatures, a most desirable thing. Deep cooking vessels with straight sides that have as little surface as possible for loss of heat and for evaporation, are the most satisfactory. It is not desirable to cook the shrimp in metal tubs, in pots or in wide, shallow kettles over open fires.

The water is brought to a jumping boil before the shrimps are dumped into the vessel. As the shrimp in cooking develop air spaces and rise to the surface, they should be held below the surface by a weighted wire screen or some similar device. During the cooking the foam should be allowed to run over and go to waste.

The length of cooking depends upon the strength of the brine, the quantity of shrimp to be cooked and the flavor desired. In general they are cooked from 15 to 20 minutes after the brine in which they are placed has begun to boil. The shorter the cooking and the weaker the brine the less will be the loss in weight. With the very weak brines continuous refrigeration of the shrimps will be necessary in order to prevent spoilage, and this will necessarily restrict their shipping to nearby markets alone. Shrimp that will be shipped to distant markets should first be cooked in 15% brine (139 pounds of dry salt to 100 gallons of water are required to make this strength of brine) for 15 to

20 minutes, cooled in a chill room to 35° F., or less, and then shipped in a sealed package surrounded by ice.

It is possible to cook shrimp with live steam, although this is but rarely done. The shrimp are sprinkled evenly with salt and allowed to stand a short time. They are then placed in a steam-tight box and subjected to the action of live steam for half an hour. This process, aside from obviating the necessity for making and handling brines, is said to require less salt, prevents soaking out of flavors and results in less loss in weight.

After cooking the shrimps should always be cooled thoroughly. In order to do this they are placed in thin layers on cooling racks of wire screens in a temperature below 50° F., if possible, and exposed to a free circulation of air. Under this treatment the crustaceans quickly lose their heat and the excess of water absorbed from the brine. Some packers determine the degree of coolness by removing the shell and breaking open the meat. This is a much more reliable method than that of merely touching the shells. Air spaces form between the meat and shell in cooking, and as the latter is a poor conductor it is frequently cold to the touch even when the meat itself is still warm.

The cans in which the dry-cooked shrimp are to be packed are lined with water-tight covers or tops which, after the cans are filled, are soldered or fastened tightly to the can. They are not processed as is the case with the smaller hermetically sealed cans. The cans used hold 1, 2, 3, 4 and 5 gallons respectively. The sealed cans then are packed in ice in burlap-covered barels with drainage holes at the bottom. Such packages are reiced by the express company when necessary, and even in warm weather can be transported in good condition.

Some are also packed in a saturated salt solution. At one time considerable quantities of headless shrimp used to be packed in this way. As these shrimp become very salty, and take a long time to freshen, they are not so popular as the dry-packed. Packing brines should not be over 5 to 10% strength. Heavier solutions tend to make the shrimp leathery and too salty, and weaker ones produce softness and flabbiness in the stock and have no appreciable preservative effect. A brine of 7 or 8% should be satisfactory for shipping purposes. In such packing both shrimp and brine should be cooled before shipping; otherwise there is danger that the ice may melt during transit and the shrimp consequently decay.

Peeled shrimp meats which are packed dry in parchment-lined cans similar to those noted above and shipped in barrels of cracked ice are rapidly coming into favor.

Shrimp Paste

Pastes made from various fishery products, by grinding up the meat and adding salt and flavoring, are becoming quite popular, and it would be an easy matter for the packers to use their broken or small shrimp, or the surplus stock taken in periods of slack markets, in making shrimp paste. It could be used for sandwiches and as a relish.

Other Products

Aside from canning, some establishments prepare dried shrimp, which are shipped in bags in this condition.

When shrimp are peeled about 43 per cent of their weight is removed. This waste matter is now saved and sold as fertilizer.

Analysis of Canned Shrimp

According to Wiley (Foods and Their Adulteration, pp. 156, 157) in the total dry edible portion of shrimp, including solids in the liquid contents of the can, are found:

	Per Cent.
Protein	86.89
Fat	3.44
Crude ash	8.84

In edible portion (flesh plus liquid)—

	Per Cent.
Water	70.80
Water-free substance	29.20
Protein	25.38
Fat	1.00
Crude ash	2.58
Extractives	0.24
Nitrogen	4.06
Total edible portion	100.00

Food Value of Shrimp Meat

According to Clark and McNaughton*, "chemical analysis shows that shrimp are a nitrogenous food containing constituents similar to those found in cheese, meat, oysters and eggs. Almost all of the edible portion of raw shrimp is protein, the muscle and tissue building food element. Since shrimp are a concentrated nitrogenous food, they may be used as the principal dish of a meal, as well as the basis of a salad or as an appetizer or relish. . . .

(Calculated on the fresh basis)

Shrimp (edible portion)—	Protein Pr. Ct.	Carbohydrates Pr. Ct.	Fat Pr. Ct.	Water Pr. Ct.	Salt Pr. Ct.	Comp. Food Val. per lb. Calories
Cooked	27.6	.....	1.0	64.5	4.8	559
Canned (dry packed)	25.5	.....	0.8	67.7	2.9	505
Canned (wet packed)	20.0	.....	0.5	75.7	1.9	395
Dry	71.4	.....	5.0	12.5	6.8	1,540"

Weights and Branding of Canned Shrimp

The U. S. Bureau of Chemistry states that, after consideration of what constitutes proper fill in case of canned shrimps, its opinion is that canned shrimp properly packed should contain not less than the following "cut-out" weights of shrimp:

Size of Can.	Dry Pack Shrimp Diameter	Height	Cut-out Weight of Shrimp.
No. 1	$2\frac{11}{16}$ in.	4 in.	5 oz.
No. $1\frac{1}{2}$	Sanitary, $3\frac{7}{16}$ in. / Hole and Cap, $3\frac{3}{8}$ in.	$3\frac{15}{16}$ in.	$8\frac{1}{4}$ oz.
No. 1	$2\frac{11}{16}$ in.	4 in.	$5\frac{3}{4}$ oz.
No. $1\frac{1}{2}$	Sanitary, $3\frac{7}{16}$ in. / Hole and Cap, $3\frac{3}{8}$ in.	$3\frac{15}{16}$ in.	$9\frac{3}{4}$ oz.

Attention is also directed to the requirement that cans should be as full of food as practicable for packing and processing without injuring the quality or appearance of contents. In the case of food packed with water, brine, etc., the cans should be as full as possible of food and should contain only enough liquor to fill the interstices and cover the product.

Attention is also called to the opinion that the label "Barataria Shrimp" should be applied only to shrimp caught in Barataria Bay, the use of such labels on shrimp caught at other places being held misbranding.

*Shrimp: Handling, Transportation and Uses. By Ernest D. Clark and Leslie McNaughton. U. S. Dept. of Agric., Bur. of Chemistry, Bulletin No. 538, p. 7. 1917.

AQUATIC MAMMALS, ETC.

TURTLES AND TERRAPINS

THE green turtle is found all along the Atlantic coast from Long Island to Central America, although very sparingly north of Florida, and on the Pacific coast from southern California south. It acquires its name from the greenish color of the fat. In its northern range the species is rather small, averaging 5 to 15 pounds. The size increases as we pass southward, the animal averaging about 150 pounds in southern Florida, and larger south of there. Along the Yucatan coast is at present the center of abundance of this species. The animal is a vegetable feeder, living mainly on marine plants, especially one called turtle-grass *(Zostera marina)*. Frequently, however, a turtle will not eat for months, especially when in captivity, and, strange to relate, this fasting does not seem to effect them either in health or weight. Owing to the persistence with which the animal has been hunted along our shores it does not now breed here, but probably has selected some little-frequented islands in the West Indies for this purpose. The flesh of the green turtle is highly prized as food, while the eggs are well liked.

The catching of sea turtles is a vessel fishery, sailing vessels of either a schooner or sloop rig being employed. The fishing season is generally from March 1 to September 30, and is confined to Florida, the principal headquarters of the fleet being at Key West. A few of the vessels visit the Mexican, Yucatan and Nicaraguan coasts, and purchase green turtles from the local turtlers.

In capturing green and logger-head turtles gill nets and pegs are generally employed.

When landed at Key West the turtles which have been kept alive (the skin of those which die is removed and salted, while the calipee, or belly, and chines are saved and salted) are placed in small, square pens of wattled stakes, called kraals, built in the water, close to shore, or in staked compartments under wharves, and there kept until the sale days or until they have recovered from the voyage.

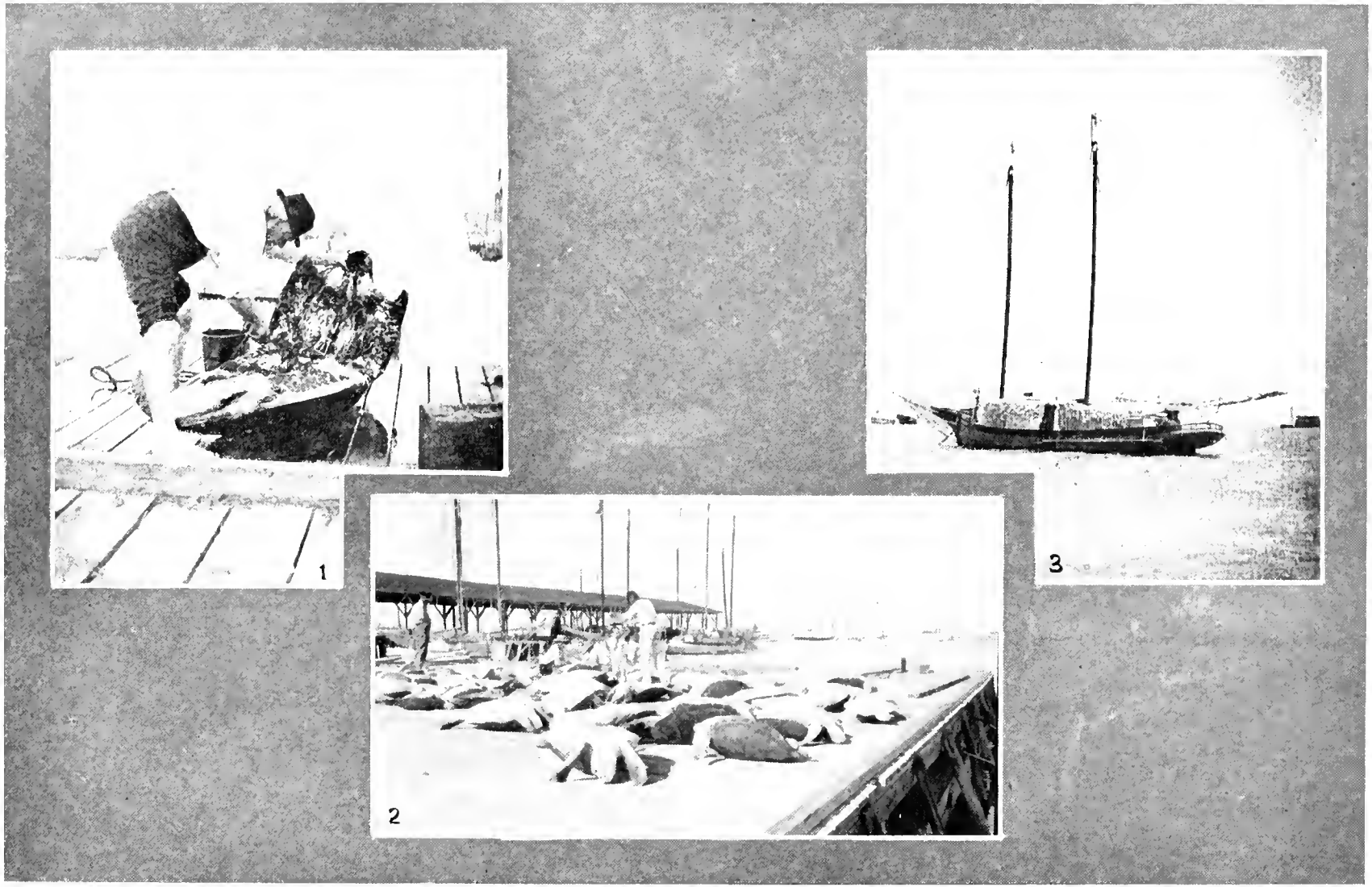
When ready to be sold the turtles are brought to one of the docks at Key West and laid on their back so they cannot move. They are then inspected by the turtle buyers, after which an unique auction is held. When ready the auctioneer advances to the first turtle, and each buyer writes on a slip of paper the amount he is willing to give for it. This is handed to the auctioneer, who lays it face down in the palm of his hand, and when all are in turns them over and reads off the highest amount offered. There is no continuous bidding, as in a regular auction, and each buyer is compelled to stand by his bid no matter how much it may vary from the others.

Turtles of from 50 to 200 pounds in weight are usually shipped to the northern markets, principally New York, on the regular steamer lines. The large turtles, some of which attain a weight of 500 pounds, are butchered at Key West and sold in the markets the same as beef and other meats, or direct to the cannery.

Green Turtle Meat*

In preparing green turtles for canning (the females are the best for this work), the head is cut off with an axe and the body hung from hooks until the blood has drained,

*In the canning of turtle and terrapin extreme care must be used to see that the rooms in which the work is done, and the utensils employed, are scrupulously clean.



THE TURTLE FISHERIES OF THE GULF OF MEXICO.

1—Dressing a Green Turtle; 2—Weighing Green Turtles at Key West, Florida; 3—A Key West Turtle Schooner (note the gill nets hung up to dry).

which will require some hours. With a sharp knife the upper and lower shells are carefully removed. The entrails and gall bladder are then removed, particular pains being taken not to break the latter. The calipash, or "clear," a fatty and gelatinous substance of a dull greenish tinge, much esteemed as a delicacy in preparations of turtle, is then cut away from the under side of the upper shell and put temporarily in a separate dish. The calipee, similar in consistency and deliciousness to the calipash, but of a light yellowish color, is removed from the inside of the under shell and saved. The upper shell is then boiled in water until the scales begin to separate, when it should be taken out and the soft mucilaginous under side scraped off and put in a dish. The under shell is also boiled in the water at the same time and will be completely dissolved.

The head, flippers, liver, lights and heart are then put in the liquor in which the shells were cooked, also the meat, enclosed in a cage, and the whole mass cooked until the meat is done. The green fat, mucilage and meat are then divided equally among the cans, the interstices of which are filled with the strained liquor, in each gallon of which has been dissolved ½ pound of gelatine. The cans are then capped and processed at 250° F., No. 1 cans for 50 minutes and No. 2 cans for 70 minutes.

Green Turtle Soup

In preparing green turtle soup prepare he turtle the same as for canning. When the meat, head, liver, etc., are cooked in the liquor in which the shells were boiled, there should be added 2 pounds of chopped onions, 3 ounces parsley, 2 ounces thyme, 2 ounces celery, 1 ounce marjoram, ½ ounce summer savory, ½ ounce sage, ½ ounce bay leaves and 2 pounds of dried ham cut in small pieces, to each 20 pounds of turtle meat. After the meat is done, remove the cage containing the meat and strain the liquor. In the meantime 1½ pounds of butter should be melted and mixed with 1 pound of flour, to which should be added 2 quarts of liquor, and the whole brought to a boil, then 4 ounces of sugar, 3 ounces of salt and 2 quarts of wine added. The thickened liquor and the meat liquor should then be mixed all together with the chopped yolks of 2 dozen hard-boiled eggs, juice of 1 dozen lemons and 1 ounce of cayenne pepper. The whole should then be placed hot in the cans, the tops sealed, and processed about 60 minutes at 230° F.

Some packers boil the meat, fat and the various other parts of the animal in 2 parts white wine, 1 part water and enough liquid to fully cover the turtle, for 1½ hours, add mixed spices, salt, cayenne pepper, thyme and sage to taste. The mixture is then drained, the juice passed through a fabric and mixed with 3 times its volume of oxtail soup, the juice of 1 lemon and 1 pint of Madeira wine to each 8 quarts of soup.

Soft-Shell Turtles

The species of soft-shell turtles, or tortoises (*Trionychidae*) are six in number. Their combined range covers most of the United States east of the Rocky Mountains. They vary in length from 6 to 8 inches to 2 feet or even more, and their weight is from 4 or 5 pounds to 15 or 16 pounds. Their food consists of small fishes, snails and other small animals, and a variety of vegetable matter. They are most frequently seen on the margin of sluggish, shallow streams, their bodies buried in the mud, and only the tip of their long snout protruding, or crawling over the muddy bottom of the stream, or floating on its surface. They breed in June and July.

Soft-shell turtles are commonly eaten in the regions where they occur, and are frequently seen in markets. Their flesh forms a superior article of food.

They are caught with hook and line, almost any bait being suitable, for they snap greedily at any kind of food. They are also shot with the rifle while sunning themselves

or floating on the surface of the water. On the Ohio River many are caught in turtle hoop nets. In winter, when the animals lie torpid at the bottom, many are taken by means of scoop nets operated through holes cut in the ice.

At Orlando, Florida, is a cannery for packing them. They are canned in the same manner as green turtles, the females being the best for the purpose.

Snapping Turtles

The snapping turtles of the United States are two in number, the common snapping turtle (*Chelydra serpentina*) and the alligator snapping turtle (*Macrochelys lacertina*). The habitat of the former is the United States generally east of the Rocky Mountains, while the latter is found in the rivers emptying into the Gulf of Mexico, from western Texas to western Florida, and northward to Missouri. It is common in the Mississippi River. The maximum size of the common snapping turtle is about 40 pounds, while the alligator snapping turtle attains a maximum weight of 140 pounds. Both species inhabit running streams and stagnant, muddy ponds and lakes, but they apparently prefer the latter. Both are carnivorous, and are sometimes seen at considerable distances from the water.

Both species are esteemed as food, the former especially in Philadelphia, Baltimore and Washington.

Many are caught in hoop nets. In New Jersey they are taken with hook and line, while others catch them with hooks baited with skinned eel. The turtles should be alive when brought to market and the females are the best for canning.

In preparing for canning the head of the turtle should be cut off with an axe and the animal hung up on hooks until the blood has stopped dripping. The animal should then be taken down and washed, and then dropped into boiling water and allowed to remain here until the shells part easily. The toe nails should be pulled out and the lower shell removed. The gall bladder should be carefully removed so it will not be broken, as in that event it would make the rest bitter, after which the liver, heart and eggs, if any, should be removed. The entrails should be removed and thrown away. The flesh should then be separated from the upper shell and cut in pieces, and placed, including skin and legs, with the heart, eggs and chopped liver, in kettle with just enough water to cover, and cooked until the skin is soft and jellylike. The whole should then be placed hot in cans, dividing the white meat and eggs as evenly as possible. After topping the cans should be processed at 250° F., No. 1 cans 55 minutes, No. 2 cans 65 minutes,

Stewed Snapping Turtle

In canning stewed snapping turtle, a meat jelly should be prepared by boiling slowly for about 9 hours veal and beef houghs, bones, sward, heads, gelatinous parts of pork, etc., with a little more water than actually required to cover them, adding enough pure salt to give it good taste, and a bunch of onions, carrots, parsley and celery. The jelly should not be highly flavored. After boiling is finished the jelly should be drained, then passed through a hair sieve and put in another kettle. Here bring to a slow boil and remove all the fat and foam that rises to the surface, then add a little vinegar to the jelly to make it slightly acid. Take the white of 3 eggs as many times as there are quarts of jelly, add to them one ounce of water per egg, and beat them thoroughly and pour the whole in the jelly, stir gently and turn the steam on. As soon as it starts boiling shut off the steam and pass the hot jelly through a wet fabric or flannel, which will clear it.

To 50 pounds of meat jelly made as above, add 50 pounds of snapping turtle as prepared for the cans, 2 pounds of salt, 1 ounce of ground cayenne and 2 ounces of ground white pepper, and 1 ounce of ground cinnamon. Bring to a boil, shut off the steam, and add one-half gallon of sherry wine. Place in cans, put on tops and process at 250° F., No. 1 cans 55 minutes, No. 2 cans 60 minutes.

Terrapin

The most famous member of the turtle family is the diamond-back or saltwater terrapin. This terrapin owes its importance as a food product not to its abundance, but to the exceptionally fine quality of its meat. It is quite scarce now, and exceedingly high in price.

The diamond-back occurs along the Atlantic and Gulf coasts of the United States from Massachusetts to Texas. In this section are found four species and one sub-species. All are lovers of salt or brackish waters and find their most congenial homes in low-lying swamps and protected bays or inlets. The female lays her eggs generally during May or June.

The female is considerably larger than the male, and as the latter is generally below the legal size but few are marketed. The flesh of the male is also said to be much tougher than that of the female, and also lacks its delicate flavor. In Florida the terrapins average about three pounds each, in North Carolina about five pounds, and in Chesapeake Bay about six pounds each.

The rapid decrease in the supply of diamond-back terrapin, coincident with the immense increase in value of same, stimulated the search for a substitute, and this was easily discovered amongst the freshwater terrapin. There are a number of genera and species of these scattered throughout our interior waters, and while all are available for food a few are either too small or of too rare occurrence to furnish any considerable supply. Those of the proper size make excellent substitutes, and have been used for this purpose for a number of years. These animals are rarely seen north of the 41st parallel of latitude, and live in moist and marshy localities and in running water.

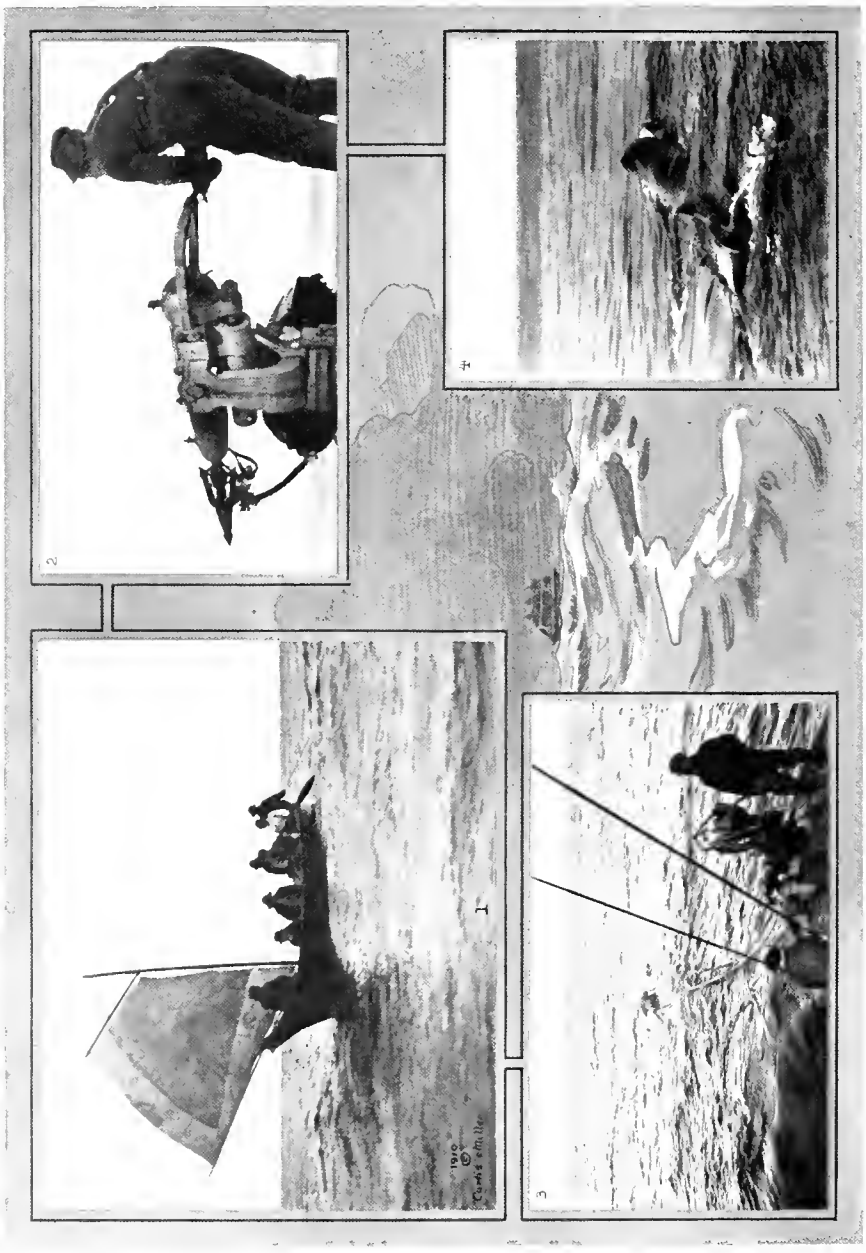
"Sliders" are abundant in the Mississippi Valley and large quantities are shipped to eastern markets, in November usually. The map terrapin is found throughout Pennsylvania and New York, and in the Mississippi Valley as far south as Louisiana. The Cumberland terrapin is found from Ohio to Kansas, southward to the Gulf states, and to the lower Rio Grande River. The red-bellied terrapin is found along the Delaware and Susquehanna Rivers and stream emptying into Chesapeake Bay. The latter, and the mobilianer, found more or less abundantly in all the Gulf states, are the largest of the freshwater terrapin.

The diamond back terrapin is occasionally canned in Georgia, although it is now so scarce and costly that they are generally beyond the reach of the canner.

As with the turtles, the female terrapin are the best for canning.

Stewed Terrapin

When ready for canning the terrapin are washed and then plunged alive into boiling water, a little salt added, and cooked until the toe-nails and outer skin come off readily, when they should be removed and the terrapin placed in clear, salted boiling water and cooked until the legs are quite tender. The terrapin should then be cleaned the same as snappers, except that the small intestines are saved and cut into very small pieces.



WITH THE WHALERS OF THE PACIFIC COAST.

1—Neah Bay, Wash., Indian Whaling Crew Seeking Whales; 2—Svend-Foyn Harpoon Gun; 3—Whale Towing Vessel After Being Struck; 4—A Good Shot.

The cut-up meat of 24 terrapin, together with the intestines, liver, eggs and liquor, should then be placed in the kettle, 10 pounds of butter added, and after this has melted 1½ gallons of cream, 1½ ounces of powdered mace and 1 ounce of cayenne pepper should be added, and all brought just to a boil; then turn off the steam and add the yolks of 6 dozen eggs, previously hard boiled, mashed and creamed with 12 pints of sherry wine. Place the prepared product in cans, seal on tops and process No. 1 cans 50 minutes at 250° F.

WHALES AND PORPOISES

For many years this country occupied the preeminent place in the whale fisheries of the world, and our whalers traversed all seas from the Arctic to the Antarctic in their quest of these leviathans of the deep. The species sought were the right, bowhead and sperm whales, the two former for the whalebone obtained from their mouth and the oil from their blubber, while the sperm was sought exclusively for the high-grade oil to be obtained from it.

In the course of time cheap substitutes were obtained for all of these products, thus causing a material decrease in their value, and this eventually led to the abandonment of the industry by most of the operators.

As "deep-sea whaling," as it was termed, declined in importance, a new style of whaling, commonly known as "shore whaling" arose to importance, and today considerably exceeds in value the old style. So far as we are concerned this form of whaling is followed on the Pacific coast alone, the stations being located in Alaska, British Columbia, Washington and California.

The deep-sea whalers had frequently encountered in the seas bordering our coasts, and elsewhere, three species of whales, as follows: Sulphur bottom (*Balaenoptera sulfureus*), finback (*B. velifera*), and humpback (*Megaptera longimana*). As the two first-named were difficult to capture with the appliances then in vogue, while all three yielded a much smaller and inferior grade of whalebone than the right and bowhead, no effort had been made to capture them. These three species comprise the greater part of the catch of the shore whalers, only an occasional sperm and right whale being caught. These whalers also catch an occasional sei whale (*B. borealis*). This mammal is common on the Japanese coast, but has not been seen on this coast until within recent years. The flesh from this species is considered the best for food, although the other species are but slightly inferior. The California gray whale (*Rhachianectes glaucus*) is also hunted off the southern California coast and its flesh forms an important addition to the local larder. The average size of this mammal is 40 feet, while the maximum is about 49 feet.

The great demand which has arisen throughout the world for fertilizers caused attention to be focused on these great monsters of the deep, and soon floating whaling stations, comprising large steamers equipped with machinery for trying out the oil and preparing the residue as fertilizer and meal, also for grinding up the skeleton bones, were equipped, at first mainly by Norwegians, and later by other nationalities.

The whales are hunted in small steamers and power vessels, in the bow of which is mounted a Svend-Foyn harpoon gun. This gun is heavily constructed throughout and has generally a bore of 3 inches. The harpoon is a heavy missile, weighing several hundred pounds. A bomb containing roughly a pound of powder is screwed onto the harpoon, and the latter is then rammed home in the same manner as a shot. About 18 inches from the point of the harpoon is attached a line, and this is attached to a larger line, which latter runs to the ship's winch.

WHALING STATION AT AKUTAN, ALASKA.

As soon as a whale is sighted the vessel is run as close to it as possible, and when within range the gun is fired. A time fuse is attached to the bomb on the harpoon, this being ignited by the discharge of the gun, and five seconds after the discharge the bomb explodes. On the shaft of the harpoon are barbs, which expand on entering the whale, making it next to impossible for the harpoon to be drawn out again. After the whale's struggles have somewhat exhausted him the whalers generally give the coup de grace with a lance, after which the animal is drawn alongside, the flukes of the tail cut off, the body made buoyant by pumping air into the stomach, and then hoisted partially out of the water and towed in to the station in this way.

The beluga, or white whale (*Delphinapterus leucas*), is quite abundant in summer in Cook Inlet and along the Bering Sea shore from Bristol Bay north, being particularly numerous about the mouths of rivers and frequently ascending the larger rivers far above tide water. It is migratory and its movements are said to be regulated by the ice. Many are found in the Kvichak, Nushagak, Togiak, Kuskokwim and Yukon Rivers. They feed mainly on fish, being especially fond of tomcods. The majority are caught with strong, large-meshed nets, heavily weighted, set off outlying points. In rough weather, when the animals cannot see the nets, many are taken, but in clear weather the catch is small. Some are speared, some shot, but unless the shot goes through the spinal column these latter generally escape. The noise of the shot also causes the survivors to almost instantly disappear. In the Bristol Bay section, when a school arrives in the headwaters of a bay or enters the river, the natives gather below it in their canoes and bidarkas, and by shouting and splashing with their oars on the water, drive the school up onto a flat and continue to hold them here until the receding tide leaves the mammals high and dry, when the natives despatch them with spears, knives and guns.

The porpoise, a small cetacean, is found in abundance on both the Atlantic and Pacific coasts. They average in length from 5 to 9 feet, and on the Atlantic coast are especially abundant at Cape Hatteras during the fall, winter and spring months. This is the only place in the United States where a regular fishery is maintained for them. Porpoises are abundant at other times, but in winter they are the fattest, and furnish the best and most profitable yield.

From the jawbone of the mammal is obtained a grade of oil which is unsurpassed as a lubricant for watches, clocks and chronometers, and this fetches a high price in the

market. Oil is also obtained from the blubber of the mammal, but this is suitable only for ordinary commercial purposes.

As the schools swim up and down the coast boats loaded with a large-mesh haul seine are launched through the surf, the school surrounded and hauled ashore with the net.

The meat is red in color and has been eaten on many occasions, and has also been used in making porpoise sausages. There is only a faint suggestion of the fishy taste. In 1918 some porpoise meat was canned in southern California. It looked and tasted very much like canned beef.

This meat can be packed in the same manner as the meat from the large whales. There is an oily taste to the meat of the beluga and porpoise which is objectionable to some, but this can be eliminated by removing the connective tissue which lies between the blubber and the meat.

Practically all species of the cetacea are dressed and handled in the same manner, although different methods are employed in capturing them.

As soon as possible after arrival at the station the whale is hauled out of the water and under the flensing shed by a powerful steam winch, where the blubber, a layer of fat directly under the skin, covering the whole body like a blanket, and varying in thickness from 4 to 7 inches, is removed and taken to the try-pots, where the oil is extracted. The remainder of the carcass is then removed to another platform, where the meat is removed. At most of the plants the oil is extracted from this meat and the residue is made into fertilizer and whale meal.

THE FINBACK WHALE, THE PRINCIPAL SPECIES USED AS FOOD.

Only the flesh of the finback, humpback, sei, California gray and beluga whales, and the porpoise, are used for food. In 1917 considerable quantities were marketed fresh and frozen, and in 1918 the canning of it was begun by certain companies operating on the Pacific coast. The hind quarters and a portion of the tail of the mammals are the parts used for canning. From a humpback whale about six tons of edible meat may be obtained, from the sei whale five tons, and from the finback eight tons. The meat of the whale resembles beef in texture and appearance, and has no fishy flavor whatever.

In the practice followed at present the influence of salmon canning methods is quite noticeable, but it is likely that better results would be obtained if meat-packing methods were followed.

At present the meat is removed in strips weighing from 15 to 20 pounds. These are at once placed in a cooling house where they remain about 8 hours for the purpose of removing the animal heat. The meat is then put in a mild pickle for 36 hours, which extracts the blood and thoroughly cleans the meat. The strips are then fed to a salmon-cutting machine, which cuts them to a size to fit the regular 1-pound tall can. The fill-

ing machine takes the pieces and fills the cans with them, about ¼ of an ounce of salt having previously been put in the can.

The top is put loosely on the can, which is then run through the exhaust box for 25 to 30 minutes at a temperature of 212° F. The double seamer then seals the can and it goes to the retort, where it is cooked for 80 minutes at a temperature of 218° to 220° F.

Upon removal from the retort it is cooled by playing a stream of cold water for a few minutes on the cooler of cans, after which they go to the cooling platform until thoroughly cooled and the tops have collapsed.

The product might be much improved if a jelly were used in filling in the interstices after the meat has been put in. This could be prepared by boiling some whale meat for

PACKING WHALE MEAT IN COOLING ROOM FOR PURPOSE OF REMOVING ANIMAL HEAT BEFORE CANNING.

a sufficient number of hours with a little more water than is actually required to cover it, adding enough salt to give it taste, and a bunch of onions, carrots, parsley and celery. The jelly should have a good taste but not be highly flavored.

After boiling drain the jelly, pass through a hair sieve and put it in another kettle. Bring to a slow boiling and remove all the fat and foam that rises to the surface.

It should then be clarified by adding a little vinegar to the jelly to make it slightly acid. The whites of 3 eggs are then taken as many times as there are quarts of jelly (5 quarts equals 15 eggs), one ounce of water per egg is then added, and the whole beaten thoroughly and poured in the jelly, after which the mass is stirred gently and the heat

CUTTING WHALE STEAKS.

turned on. As soon as it starts boiling shut off the heat and pass the hot jelly through a wet fabric or flannel, when it will be clear.

The meat could be roasted the same as beef and then canned, or could be corned before canning. This would require some experimental work, as whale meat might require somewhat different treatment from beef, but the differences would doubtless be slight.

Analysis of Canned Whale Meat

At the request of the American Pacific Whaling Company of Bay City, Wash., the U. S. Bureau of Fisheries in 1918 made an analysis of canned whale meat with reference to its food value, the results of which are shown in the accompanying table. It is noteworthy that this product is rich in protein, the principal tissue-forming material of food, which constitutes over 34 per cent. of whale meat, as compared with 13 to 14 per cent. in beef, mutton and pork.

In the table the caloric determinations of fuel value per pound are based on the percentage of protein—Nx6.25—rather than on the percentage of nitrogenous substances by

difference. The fuel value per pound is determined by the use of factor 9.3 per gram for ether extract and factor 4.1 per gram for protein—Nx6.25.

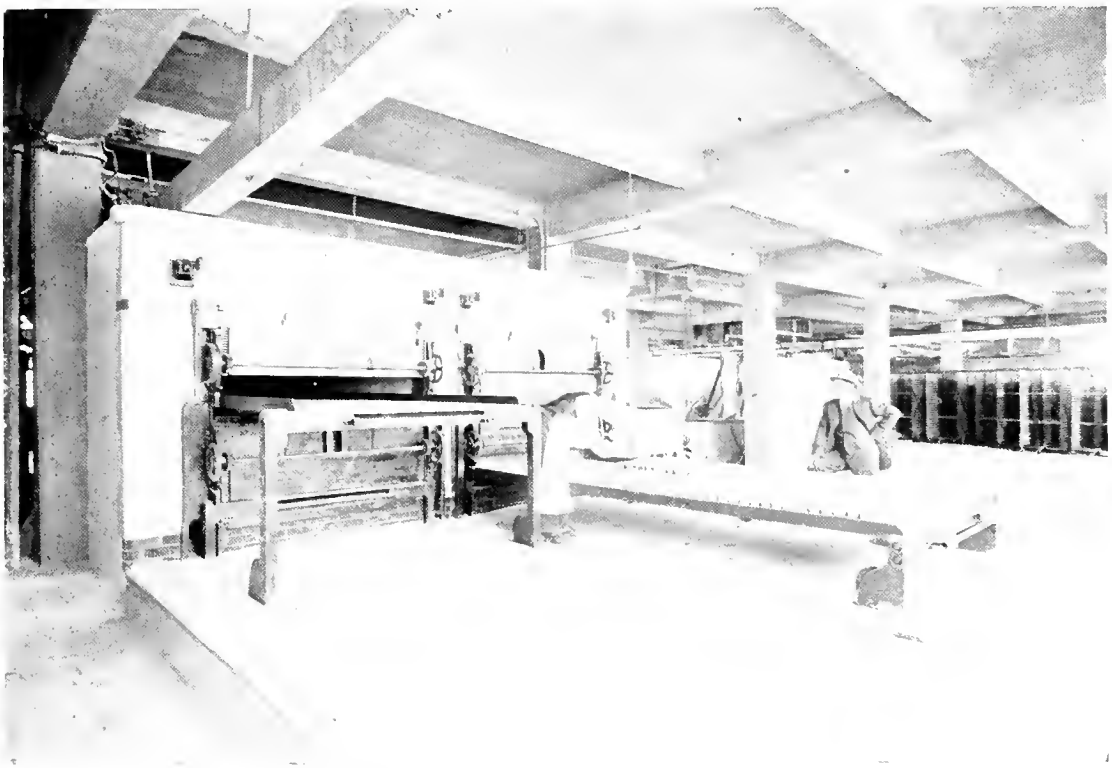
	Moisture, Per Cent.	Solids, Per Cent.	Ether Extract or Fat, Per Cent.	Ash, Per Cent.	Nitrogenous Substances by Difference, Per Cent.	Nitrogen, Per Cent.		Protein, N. X. 6.25, Per Cent.	Fuel Value Per Pound, Calories
Average of two Determinations	59.57	40.43	4.96	.95	34.52	5.49	or	34.31	847
Individual Determinations	60.64	39.36	4.92	.95	33.49	5.38	or	33.63	832
	58.51	41.49	5.01	.94	35.54	5.61	or	35.06	863

MISCELLANEOUS SECONDARY PRODUCTS

FISH BALLS

THE making of fish balls and canning of same has been carried on in a desultory fashion for a number of years. The usual custom has been to use cod or other member of the Gadidae in this work, but the canner of today has a wide range of material from which to select—cod, haddock, hake, salmon, drum, sea basses, tenderloin of sole, flounders and many others.

The usual method of preparation is as follows: For 100 pounds of fish, 125 pounds of potatoes, 10 pounds of raw onions and 13 pounds of pure beef tallow are required. If salt fish are used they are soaked in tepid water to remove the salt. The fish are then reduced to a pulp; the potatoes are boiled, skinned and mashed; and these ingredients



INTERIOR OF CANNERY PACKING FISH BALLS, ETC.

are warmed and mixed thoroughly with the chopped raw onions and beef tallow, adding 6 ounces of pepper or other suitable flavoring condiments. While the ingredients are being mixed they are chopped as fine as practicable by machinery. The warm mixture is then placed in the cans, which are then sealed up. As the mixture is warm no exhausting is necessary. The cans are then processed, 1-pound, 45 minutes at 240° F.; 3-pound, 60 minutes at 221° F., and 10-pound, 90 minutes at 240° F.

FISH PASTES

In Europe the manufacture of pastes from fishery products has attained to considerable prominence, anchovies, bloaters, shrimp, etc., being the principal materials used. In this country but little paste is made, and this principally of salmon, although many other fishery products could be utilized. The hitherto waste pieces, such as the napes of codfish, tail pieces of salmon, etc., are generally employed for this purpose.

The meat of fish should be thoroughly cleaned of bones and skin and run through a meat grinder. It should then be thoroughly mixed in a mixing machine with oil, spices and other flavoring substances until it is of the right consistency and flavor. This is largely a matter of taste and each packer will have to decide for himself as the taste of the consuming public varies in different places. The mixture is then run into cans, the top put on loosely, exhausted 15 minutes at 206° F., top sealed and the cans processed 45 minutes at 230° F.

In Japan lean pieces of fresh flatfish, eels, shark, etc., are freed from the bones, pounded in a stone mortar, and at the same time mixed with a certain quantity of salt, flour, sweet wine, white of an egg and saccharifcrous algæ (Laminaria), until the mixture assumes a paste-like consistency. The Japanese mould this mixture into various shapes, heat it over a charcoal fire, then steam and bake it. It could, however, be run through the machines noted above, put into cans and processed as there noted.

Anchovy Paste

Paste made from our anchovies would be fully the equal of the best anchovy paste put up in Europe. There are several methods for preparing paste, but the favorite seems to be as follows: For each gallon of fish take 1 pound of salt, ½ pound of saltpeter, 1 ounce of sal prunella (saltpeter deprived of water by crystallization by heat) and a few grains of cochineal, and pound the whole well together in a mortar. In a stone jar place a layer of the ingredients, then a layer of fish, and so on until the jar is filled, press them down hard and cover up carefully, and let them remain for six months, when the paste is ready for use.

FISH PUDDING

Fish pudding can be made from a variety of fishes and in a variety of ways. Cod, haddock, hake, salmon, whiting, halibut, flounder, sole, etc., have been utilized at various times.

The fish to be used should first be eviscerated, then boiled or baked, the skin and bones removed, and the flesh ground fine in a machine, after which it should be run through a sieve. The fish pulp should then be seasoned with salt, pepper and onion juice. Some butter should then be melted in a vessel; when melted add potato flour and cook for a few minutes; then add slowly the milk, stirring constantly until well scalded; then add the fish pulp, take from the fire and mix thoroughly. The whole should then be pressed well down into a half-gallon can, or whatever size may be convenient, the top put on loosely and the can exhausted for 15 minutes at 212° F., then sealed tight and processed for 75 minutes at 227° F.

No effort has been made to give the exact quantity of each ingredient used, as this will have to be worked out largely by experiment, and also because the taste of the consuming public varies in different sections, and the packer should endeavor to supply what his trade particularly wants. Some packers may want to eliminate certain of the ingredients shown above and substitute others to suit their own special demands.

The product should be firm enough to turn whole out of the can, when it can be cut in slices, the same as plum pudding, and served.

FISH EGGS AND MELT

Among the choicest of secondary products obtained from many species of fishes are the eggs with which the females are frequently freighted when they are captured by man. In a cooked state it would be difficult to find a more delicious dish than cod, shad or alewife roe, while sturgeon caviar made from the eggs of the sturgeon is favorably known the world over. Unfortunately, however, with the exception of the latter, the eggs of fish are accessible to but comparatively few people, due to the fact that most of them are marketed in a fresh state, which very materially curtails their sale and distribution. The wide vogue of sturgeon caviar is due primarily to the fact that it is cured in such a way that it will keep for a long period of time, and being put up either in cans or air-tight kegs can be shipped anywhere with perfect safety. Owing to the great scarcity of sturgeon caviar, due to the demand and consequent high prices having caused such intensive fishing that the various species of sturgeon are now extinct in many waters, while in others they run in greatly reduced numbers, substitutes have been sought and found in this country in the spoonbill cat or paddle-fish, salmon, whitefish, etc.

In addition the roes of many fishes could be canned either in a fresh or salted condition, the principal species being herring, alewife, shad, whitefish, cod, haddock, etc.

At the present time immense quantities of fish eggs are allowed to go to waste for the lack of curing and packing methods which would permit of their preservation and shipment to the markets of the world. Salted, they would be available for many markets; but it is only in a canned condition that they are available for world-wide markets.

According to the U. S. Bureau of Fisheries, fish eggs "are essentially nitrogenous foods, with a considerable quantity of fat, and differ in composition but little from the flesh of the fish. They do, however, contain a larger quantity of an important constituent of food, organic phosphorus in the form of lecithin. The fresh roe contains less water than the flesh, and therefore pound for pound has a larger quantity of nutrients. For purposes of comparison some tabulated analyses follow. In comparing analyses of the canned with the fresh products, it should be borne in mind that water is added to the product in the cans when it is put up.

ANALYSES AND FOOD VALUE OF FISH, FISH ROE, BUCKROE, ETC.

Kind.	Water, Per Cent.	Dry Flesh, Per Cent.	Protein, Per Cent.	Fat, Per Cent.	Ash, Per Cent.	Total Nutrients Per Cent.	Fuel Value Per Pound, Calories
Shad (dressed)	70.62	29.28	18.55	9.48	1.25	28.03	744
Shad roe (fresh)	71.25	28.75	23.44	3.78	1.53	27.22	595
River herring (dressed)	74.41	25.59	19.17	4.92	1.47	24.09	564
River herring roe (canned)	79.67	20.33	14.25	a4.84	1.24	19.09	469
River herring buckroe (canned)	81.21	18.79	a14.19	2.41	2.19	16.60	365
Pollock buckroe (canned)	79.39	20.61	13.68	2.62	3.98	16.30	365
Sea herring buckroe (canned)	79.25	20.75	15.54	2.72	2.49	18.26	403
Sea herring roe (fresh)	69.22	30.78	a25.21	4.19	1.38	29.40	645
Sturgeon caviar	66.05	33.95	14.37	8.97	b7.26	23.34	645
Hen Eggs	65.50	34.50	13.10	9.30	.90	22.40	635
Chicken (dressed)	71.30	28.70	24.30	2.60	1.40	26.90	561

a By difference. b Of this total 6.16 parts salt is used in preserving product.

"The buckroe or melt roe (that part of the male which corresponds to the egg mass of the female and is sometimes called soft roe), as shown by analysis, compares favorably in food value with the roe and flesh of the fish. It is, in fact, a most excellent product, a delicate and palatable fish food, and has been so pronounced by teachers of domestic science and others who have given it a trial."*

Alewife Eggs and Melt

The U. S. Bureau of Fisheries suggests the following method for canning alewife eggs and melt:

"Herring roe intended for canning is collected in buckets as the fish are cut and washed in fresh water in special trays, blood and adhering particles of entrails being removed. The roe is then put in the cans. As it swells considerably in processing the cans must not be entirely filled. If of the sanitary type, the cans are filled to within about three-fourths of an inch of the top with roe and then filled to the edge with cold salt brine, about 1 pound of salt to 8 or 10 gallons of water being used to make the brine. The brine is added solely for seasoning. The cans are immediately capped and placed in the processing baskets. If solder-top cans are used, the filled cans are placed in the exhaust box. Upon removal from the exhaust [the exhaust should be at 212° F. for a period to be determined by experiment.—Author] the necessary air space is provided for by pressing the roe down with a plunger. Material clinging to the groove where the solder is applied is removed by a brush and the cans are capped and tipped. The canned roe is processed in a closed kettle for 45 to 55 minutes at a temperature of 240° to 245° F. The melt roe may be canned in the same manner as the roe except that the cans can be more completely filled, as this product does not swell in processing. As the quantity of brine used in this case will be somewhat less, it should be made correspondingly stronger."*

Cod Eggs

Large quantities of eggs from cod and kindred fishes, as haddock and ling are going to waste in our fisheries through lack of effort at curing them as caviar and pushing their sale in this and other countries. The cod spawns during the winter and early spring, and at this season the Alaska shore-fishing stations devoted to cod throw away many thousands of pounds which rot or form food for the gulls. The Norwegians have developed a method of preparing cod caviar, which seems to be meeting with much favor, and which could be adapted in this country with much profit. It is as follows:

"For the preparation of cod caviar the Norwegians use the whole ovaries of the cod, which are salted in barrels, and mostly in the Lofoden winter fisheries. The roe must be salted whole without injuring or breaking the enveloping membrane, and must not be salted too much, just sufficient to impart a nice orange-red color. When the salted ovaries are removed from the barrels they are first thoroughly washed several times in fresh water and then hung on wires or ropes in the open air, but protected from too strong sunshine. After they have dried for about 24 hours they are taken down for smoking. For this purpose they are hung in the same way in the smoking-house on sticks or rods or put on frames covered with old nets or wirework and cold-smoked for two or three days, or until they become of a dark-brown color. After smoking, the enveloping membrane or skin of each roe sack is torn and removed, and the eggs packed

*Fish Roe and Buckroe. U. S. Bureau of Fisheries, Economic Circular No. 36, pp. 1-2. 1918.
*Rep. U. S. Com. of Fisheries for 1917, p. 45. 1917.

in good, tight barrels, which are then tightly closed and placed in a normally cool place for a month or six weeks. At the end of that period the eggs begin to ferment somewhat, which may be detected by the swelling of the barrel. It is well not to wait too long, but to examine the barrels every week or so, and as soon as fermentation has begun a sufficient quantity of salt should be put into the roe, to prevent the product from spoiling.

"By fermentation the roe receives a slight acid flavor and a taste resembling that of fermenting beer or wine, and this fermentation must be stopped by adding salt at a definite point, which is to be learned by experience only. The salt used to stop the fermentation must be of the very best quality, and if the roe seems to be dry a little good French olive oil is added to moisten the product. After the roe has been thoroughly mixed with the salt it is put in 1-pound glass bottles that are sealed with cork stoppers."*

Mullet Eggs

Mullet roe is also a very valuable food, and large quantities are sold fresh, salted, smoked and dried each year. In 1908 the quantity of roe marketed amounted to 135,000 pounds. Canned roe from various fishes is meeting with much favor from consumers at present and it is probable that if prepared in the following way, or with such changes as experience may suggest, that a good food product may be obtained.

All adhering shreds and strings, if any, should be cleaned off, the roe washed in cold water, then soaked two hours in 3% brine, drained and packed in cans. After capping the cans are exhausted for 10 minutes at 212° F., and then processed 60 minutes at 240°F.

Sea Drum Eggs

Sea drum (*Pogonias cromis*), described elsewhere in this book, is an excellent food fish, and the female of the species has a roe which is considered a great delicacy and is often salted and dried, and also might be canned, the same method being followed as is used with other fish eggs.

Shad Eggs

Considerable quantities of shad eggs are canned on the Columbia and Sacramento Rivers in the west, and Chesapeake Bay in the east. The roes are carefully washed in brine and then are placed in the cans by hand, with either brine, oil or sauce added, and sealed. Some canners exhaust the cans in the steam box for 4 minutes, while others do not consider it necessary to exhaust. They are then processed for about 75 minutes at a temperature of 240° F. In the west they are packed in 8 and 12-ounce oval tins, the roe being held as nearly whole as possible. The eastern packing is done in 1-pound and No. 2 cans, the roe being cut or minced.

A small quantity of shad roe is brine-salted in the Atlantic coast fisheries, especially in North Carolina, Virginia and Maryland, but there is not much opportunity to enlarge the business here owing to the heavy demand for roes in a fresh state. In this work the roes are removed from the fish in dressing the latter, care being taken not to cut or injure the roe bags. They are then washed by stirring with the hands in tubs of water, and are placed in tubs of strong brine with dry Liverpool salt sprinkled among them and at the top. Every 12 hours during the ensuing five days the roes are gently stirred to separate them from each other, and to have them uniformly salted. The sixth day they are removed from the pickle, drained and may then be packed in kegs or in cans.

*The Preservation of Fishery Products for Food. By Charles H. Stevenson. Bulletin U. S. Fish Com. for 1898, p. 548. 1899.

The following analysis of shad roe shows its value as a food product: Water, 71.2 per cent.; protein, 23.4 per cent.; fat, 3.8 per cent., and ash, 1.6 per cent.

MELT OR BUCKROE

The melts, or buckroe, as it is sometimes called (that part of the male which corresponds to the egg mass of the female), of fishes are also an excellent food, but have been almost totally neglected until within recent months. As noted above, it compares favorably in food value with the roe and flesh of the fish. It is fully as abundant as the roe, and there are no real difficulties in the path of the canner in packing it, provided a market can be built up for the product. The melts of river herring or alewife, sea herring, pollock and salmon have so far been utilized, but only to an extremely limited degree.

In canning the buckroe it should be washed thoroughly in a brine solution as soon as possible after removal from the fish. As with the roe, it is best if the melt be obtained immediately after the fish is killed, as stale melt will not make a good canned product. Should the melt prove quite watery it may be allowed to stand in the brine for a period to be determined by experiment. The brine will draw out the moisture and harden the melt. It should then be placed in the cans, $\frac{1}{4}$ of an ounce of salt being added for flavoring. The tops should then be put on loosely and the cans run through the exhaust box for 12 or 15 minutes at 212° F., the tops then double seamed and the cans placed in the retorts and processed for about 50 minutes at 250° F. The above process should be used with care, and changed whenever examination of the pack indicates the necessity therefor.

Salmon Melt

For many years natives and a few whites living on our Northwest coast have been eating the melt taken from the male salmon when on his way to the spawning grounds. It has been found a most excellent food when treated and served in the proper manner. As salmon run each year in millions the supply available is enormous, and if canning is followed the work can be carried on in the regular salmon canneries, no special machinery being required.

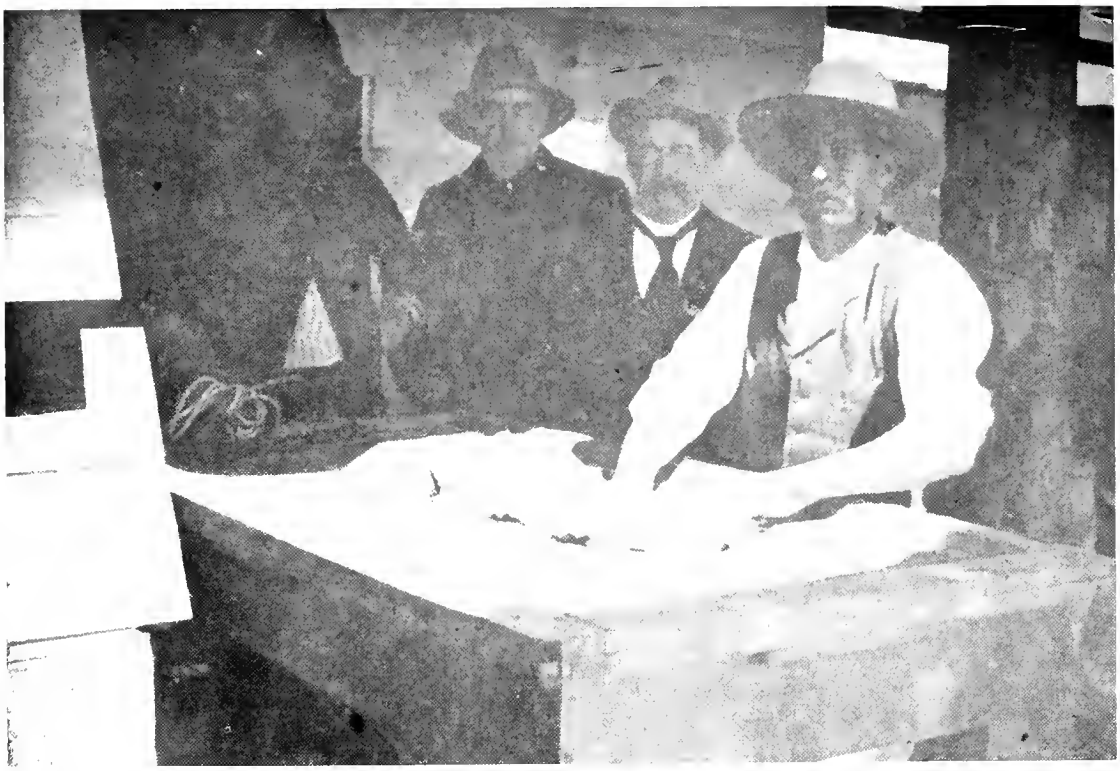
After being removed from the fish the blue vein or muscle running through the center is removed and the melt is then washed thoroughly in a brine solution, which not only cleanses but also hardens it somewhat. It is then placed in cans, in which $\frac{1}{4}$ of an ounce of salt has been placed for flavoring, the top put on loosely, after which it is run through the exhaust box and the double seamer the same as with canned salmon. They are then put in the retort, where they are cooked for about 15 minutes at a temperature of about 245° F.

The above process should not be followed too slavishly, as but few have so far been packed in cans. The excessive amount of water which has appeared so far in the melts canned indicate clearly that some method of eliminating a considerable part of this moisture before placing in the can must be devised. Allowing the melts to remain a little longer in the brine solution might accomplish the desired result.

CAVIAR

In canning caviar the packer should be particular in labeling the product to state from which species of fish it was prepared, as "Spoonbill caviar," "Salmon caviar," "Whitefish caviar," the U. S. Bureau of Chemistry ruling (Service and Regulatory

REMOVING EGGS FROM BELLY OF STURGEON.



RUBBING EGGS THROUGH SIEVE IN TOP OF TABLE TO REMOVE MEMBRANE FROM THEM.

Announcement, issued May 12, 1914, p. 112) says, in part: "It is believed that the name of the particular fish from whose eggs caviar is made should appear on the label."

About 1875 a New York dealer initiated the domestic caviar preserving industry by canning the roe of sturgeon, thus making it available for shipment to any part of the world.

A 1-pound can of caviar should have the top put on loosely, exhausted 10 to 15 minutes at 212° F., the top sealed on and processed about 50 minutes at 250° F.

The following description of the methods followed in preparing sturgeon caviar will serve in all essential features for the preparation of caviar from the eggs of other species. Where the process differs these differences alone will be shown.

Sturgeon Caviar

By far the most valuable substance obtained from the sturgeon is the roe, from which the product called caviar is prepared; this is the most costly food product obtained in our fisheries. For this only the hard roe of the "cow" fish is supposed to be used. The quantity of roe obtained from each fish varies considerably. The Atlantic sturgeon yields from 6 to 12 gallons, the Columbia River sturgeon nearly as much, while those from the Great Lakes average only 2 or 3 gallons to the fish. The manner of preparation is as follows:

After the eggs have been removed from the fish, which should be done at the earliest practicable moment after the fish is caught, they are placed in large chunks upon a stand, the top of which is formed of a small-meshed screen. On the under side is arranged a zinc-lined trough, about 18 inches deep, 2 feet wide and 4 feet long. The operator gently rubs the mass of eggs back and forth over the screen. The meshes are about 4 to the inch, and are just large enough to let the eggs drop through, and as they are separated from the membrane by the rubbing they fall through into the trough and are thence drawn off into tubs by means of sliding doors at the end of the trough. After all the roe has been separated from the membrane the tub is removed and about 8½ pounds of the best Luneberg or Liverpool salt, or 4¼ pounds of dairy salt (the quantity used varies with the packer, some using as high as 10 pounds of the former, and an equal quantity of the latter when it is used), added to each 100 pounds of the roe. In cold weather less salt is used than in warm weather. For the caviar to retain its delicious flavor the roe must be mildly cured. If too much salt has been used the caviar on being treated by the canner will taste so strongly of salt as to be practically unsalable.

The operator then carefully stirs and mixes the mass with his hands. The most delicate part of the whole operation is in the manner of mixing. No direct rule can be given for doing this portion of the work, as the condition of the roe regulates the time consumed and the manner of handling. It requires practical experience to become proficient.

Using both hands, thoroughly mix the eggs and salt for 5 to 8 minutes, until a foam or slime appears on the top of the egg mass. Allow the mass to stand for 10 minutes and then mix again for a few minutes. By this time a copious brine should have been formed so that the eggs will pour readily. If the operation has been properly carried out a slight noise, like small pieces of glass rubbing against one another, is perceptible when the mass is stirred.

The salted eggs are poured into very fine meshed sieves (the meshes should be about the same as used in flour sifters), which hold about 10 pounds each. In the caviar house are usually arranged long, sloping boards, with narrow cleats nailed on each side. On

these the sieves are placed, and are left there until the brine is entirely drained off, when the mass will crack open if the bottom of the sieve is pushed up at one point. The eggs have now become the caviar of commerce, and are transferred to small casks, of either oak or pine, which have been steamed to prevent any possible leakage; the casks are covered and allowed to stand until the gas escapes and the eggs settle. The vacant space caused by the settling is then filled and the cask headed up and put in a cool place until ready for shipment. The casks used on the Atlantic coast hold about 135 pounds net, while those used on the Great Lakes hold about 160 pounds, and those on the Columbia River about 145 or 150 pounds.

Formerly only the hard roe was used in making caviar, but some of the fishermen have become so expert that they can handle roe which is medium soft and still prepare a fair grade of caviar. Others who are not quite so scrupulous as the majority even put up the quite soft roe; as the eggs, when ripe, have become detached from the membrane, it is not necessary to run them through the sieve. They are then put in pickle to cure them, and, after being allowed to drain, are placed in the middle of a cask, with good caviar at the top and bottom.

The best caviar made in this country is from the eggs of the lake sturgeon, these being larger and of a more uniform color than those of the common species (*Acipenser sturio*). The latter is the sole source of caviar produced on the Atlantic coast. On the Gulf coast caviar is prepared from *A. brevirostris*. The caviar prepared on the Pacific coast is from *A. transmontanus*. The poorest grade is prepared from the shovel-nose sturgeon (*A. scaphirhynchus*) found in the Mississippi Valley. Caviar of a mixed color is not so valuable as that made from eggs of uniform color, and care should be taken to prepare each roe separately should the roes vary in color.

In storage the caviar should be held at a low temperature, 38° to 40° F. being found most satisfactory, and under favorable conditions it may be kept for several years.

The greater part of the caviar prepared in this country is shipped to Germany and goes usually in the original package. When prepared for the domestic retail trade the caviar is put up in hermetically-sealed cans. When prepared in this manner it is sometimes subjected to a process different from that employed for packing it in kegs.

The usual size of cans for the retail trade in this country is ¼ pound, ½ pound, 1 pound and 2 pounds.

Paddlefish Caviar

The best substitute for sturgeon eggs in making caviar are the eggs of the paddlefish (a description of this species occurs elsewhere in this book), a freshwater species found in the Mississippi Valley.

So far as is known the paddlefish spawns in the lower Mississippi Valley, where the species is found in greatest abundance, during March and April, while in the Ohio and northward it spawns during the latter part of May and June. The eggs are greenish-black in color, closely resemble sturgeon eggs, and are very numerous. In preparing the eggs as caviar and then canning the product the same method is followed as with sturgeon caviar.

Salmon Caviar

In the aggregate the wastage of salmon eggs is enormous. In 1918 some 600,000,000 pounds of salmon were caught by the fishermen of the Pacific coast, including British Columbia, and these would have produced about 34,200,000 pounds of roe, which, when prepared as caviar, would have amounted, on a very conservative estimate, to about

15,000,000 pounds. Not all of this quantity of roe could be saved even under the most favorable conditions, but it shows very clearly the immense quantity of raw material now thrown away.

A considerable quantity of salmon caviar is now being prepared annually in Siberia. Here, and it is probable the same would apply on this coast, it has been found that there are differences in the caviar produced from the various species of salmon, the runs of which occur at different periods of the fishing season, that is, spring, summer and autumn, and a marked difference has been noted in eggs taken from fish caught on or near the sea coast as compared with fish caught farther up the river, and it has been found that the eggs taken from fish caught upstream are too ripe for caviar manufacture, as the completed product turns yellow, whereas good salmon caviar should be a bright golden red. In Siberia it is claimed that the humpbacks yield about 90 pounds of caviar per 1,000 fish; the red or sockeye about 126 pounds per 1,000 fish; and the coho or silver about 144 pounds of caviar per 1,000 fish.

Miss Ida Tuholski, of San Francisco, has been the most successful packer of salmon caviar on this coast. She tries to obtain the roe from live salmon, and in doing this kills and bleeds the fish, opens up the belly and removes the roe, care being taken to avoid rupturing the gall bladder, as this would ruin the caviar. She then puts the eggs into water almost too hot for the hands in order to clean them of dirt, slime, possible parasites, etc. The eggs are then run through the screen to remove the membrane. If they are to be canned she then cures them by dry-salting with Liverpool salt.

Most packers, however, use the common method of working the eggs with salt until a copious brine is formed. Some Siberian packers use Lunebnrg salt, while others use No. 2 Berkshire salt from England. The succeeding operations are practically the same as employed in making sturgeon caviar.

Most of the Siberian salmon caviar makers prepare their product by putting the eggs into a brine solution of 19 to 22° Baume strength immediately after they come from the trough. The eggs should remain in the solution 25 to 45 minutes, governed by the strength of the brine and the temperature. The brine hardens the eggs, but they must not be kept too long in the brine or the caviar is oversalted, and almost worthless, especially for canning. When sufficiently pickled in the brine the eggs are placed in coarse, thin bags under a press and squeezed until the milky albumen of the egg oozes through. This pressure, although great, does not crush the eggs, as they are flexible, and it causes a shrinkage in the weight of the caviar of about 40%. The surplus fluid is allowed to run off and the caviar is then either canned at once or packed in steamed wooden kegs, which have previously been lined inside with cheesecloth or linen, and handled as previously noted.

One Siberian canner packed some caviar in cans and sealed them without either exhausting or processing, and the product remained in good condition for a considerable time.

German Carp Caviar

The number of eggs found in a spawning female is very large; it is said one weighing from 4 to 5 pounds will contain on an average 400,000 to 500,000 ova. One weighing 16½ pounds is said to have had 2,059,750 eggs. These eggs are quite small. The scarcity of sturgeon and the high price obtained for the caviar naturally suggests the possibility of using the roe of the carp for this purpose. Several persons on the Great Lakes have attempted to prepare the eggs as caviar, but all met with failure because in the process the eggs turned pink or red, a characteristic known from early times. It is possible that

a trade for this might be developed amongst the Jews, who generally do not eat caviar made from sturgeon, and are familiar with the change in color of the eggs.

Pike Caviar

In Germany a form of caviar is made from the eggs of the pike in the following manner: The fresh eggs on removal from the fish are rinsed in cold water and rubbed through a coarse sieve to separate them from the membraneous tissues enveloping them. On completion of this they are rinsed two or three times and then placed in a finer-meshed sieve to drain. Next they are well mixed with fine salt and flavoring ingredients, there being added to each 100 pounds of eggs about 3½ pounds of fine salt, 2½ ounces of citric acid and a small quantity of lemon oil. After being thoroughly mixed with these ingredients the eggs are put in a cool place, and after remaining undisturbed for eight days the jars or tubs containing them are tightly sealed.

Whitefish Caviar

Some business is being developed in the manufacture of caviar from whitefish (*Coregonus*) eggs and its subsequent canning. This genus has a very wide distribution on the North American continent, as will be noted by reference to description of the family and its habitat, etc., elsewhere in this work. The eggs are prepared in practically the same way as sturgeon eggs, but as they are almost transparent burnt sugar is used in coloring them so they will more nearly resemble the latter.

Miscellaneous

Caviar has also been prepared from the eggs of the lake herring (*Leucichthys*) and other species. Descriptions of the species named, with their habitats, etc., will be found under their proper heading in this book.

MISCELLANEOUS INFORMATION

PRODUCTS OF THE COMMERCIAL FISHERIES OF THE UNITED STATES.*

States	Fishes		Other Edible Products		Non-Edible Products		Total Products*	
	Pounds	Value	Pounds	Value	Pounds	Value	Pounds	Value
Alabama	7,178,700	$ 269,600	3,359,819	$ 79,484			10,538,519	$ 349,084
Alaska	460,301,646	7,770,532	97,319	7,186	8,395,664	$ 635,995	468,794,629	8,413,713
Arizona	80,000	6,400					80,000	6,400
Arkansas	4,475,100	133,200	33,000	4,100	8,060,050	70,100	12,568,150	207,400
California	178,450,472	5,353,514	23,757,782	2,138,190	797,812,174	205,894	1,000,020,428	7,697,598
Colorado	1,360,166	185,493					1,360,166	185,493
Connecticut	65,055,070	593,837	29,201,635	2,048,761	95,592 810	389 419	189,849,515	3,032,017
Delaware	5,278,200	208,100	3,759,996	243,617	66,854,830	274,476	75,893,026	726,193
Florida	61,548,640	2,361,093	14,621,629	422,580	4,330,444	636,416	80,500,713	3,420,089
Georgia	4,505,800	344,000	7,993,579	275,683	700	3,600	12,500,079	623,283
Idaho	1,640,000	220,000					1,640,000	220,000
Illinois	40,363,454	1,280,187			14,926,000	338,398	55,289,454	1,618,585
Indiana	1,076,900	67,950			18,488,000	251,343	19,564,900	319,293
Iowa	5,222,493	228,089	95,500	2,900	4,700,500	45,600	10,018,493	276,589
Kansas	432,000	28,000			157,000	2,356	589,000	30,356
Kentucky	1,975,100	90,100	1,900	90	3,413,000	18,000	5,390,000	108,190
Louisiana	11,093,400	428,800	50,382,700	1,322,178	350,500	126 700	61,826,600	1,877,678
Maine	263,231,482	4,892,686	39,314,587	2,847,541	44,910	2,420	302,590,979	7,742,647
Maryland	65,057,784	724,118	58,974,535	2,468,715	15,621,911	105,058	139 654,230	3,297,891
Massachusetts	201,973,031	6,434,259	10,018,190	1,210,697	4,239,000	347,800	216,230,221	7,992,756
Michigan	29,251,327	1,469,615			923,000	26,613	30,174,327	1,496,228
Minnesota	32,601,679	1,394,147	687,500	275,;00	2,144,000	53,115	35,433,179	1,722,262
Mississippi	8,520,600	163,500	14,075,340	325,502			22,595,940	489,002
Missouri	6,478,900	242,800	91,900	11,500	212 200	18,230	6,783,000	272,530
Montana	110,000	6,000					110,000	6,000
Nebraska	399,000	22,000			55,000	610	454,000	22,610
Nevada	107,536	12,834					107,536	12,834
New Hampshire	642,000	51,600	336,710	109,960			978,710	161,560
New Jersey	51,663,426	1,497,592	19,748,819	1,298,770	22,277,610	62,644	93,689,855	2,859,006
New Mexico	70,000	4,900					70,000	4,900
New York	14,872,296	1,605,560	39,173,444	3,879,281	95,221,710	352,619	149,267,450	5,837,460
North Carolina	38,283,700	1,731,900	4,880,144	279,428	47,593,110	125,300	90,756,954	2,136,628
North Dakota	100,000	7,000					100,000	7,000
Ohio	31,016,159	1,614,478			50,000	1.236	31,066,159	1,615,714
Oklahoma	86,700	4,300					86,700	4,300
Oregon	35,207,424	1,518,326	700,199	49,268			35,907,623	1,567,594
Pennsylvania	13,147,367	582,100	738,878	56,225			13,886,245	638,325
Rhode Island	34,767,000	695,100	18,191,002	1,656,961			52,958,002	2,352,061
South Carolina	2,988,600	140,200	5,152,768	106,677	100	75	8,141 468	246,952
South Dakota	70,000	4,200			260,000	4,198	330,000	8,398
Tennessee	2,329,300	97,200	6,700	1,200			2,336 000	98,400
Texas	8,864,671	380,453	2,601,999	156,888	7,070	1,450	11,473,740	538,791
Utah	1,481,863	67,458					1,481,863	67,458
Vermont	678,682	45,069					678,682	45,069
Virginia	128,102,295	1,333,342	75,551,968	3,334,991	291,305,099	1,012,682	494,959,362	5,681,015
Washington	145,303,549	5,970.679	3,426,439	541,384	4,383,125	141,632	153,113,113	6,653,695
West Virginia	33,000	2,000					33,000	2 000
Wisconsin	24,691,448	871,015	438,181	9,212	6,304,000	153,672	31,433,629	1,033,899
Wyoming	230,000	13,800					230,000	13 800
Hawaii	6,556,217	635,366	416,518	42,531			6,972,735	677,897
Total	1,998,954,177	53,604,492	427,830,680	25,206,500	1,513,723,517	5,407,651	3,940,508,374	84,418,643

THE CANNING INDUSTRY IN 1914

The U. S. Bureau of the Census in 1915 collected statistics of the canning industry of the United States, exclusive of Alaska, for the calendar year 1914, and this is the most recent report covering the industry as a whole. The following is a condensed summary of the report, showing by cases, value and states the various products packed:

FISHERY PRODUCTS CANNED IN 1914*

PRODUCTS AND STATES	CASES	VALUE
Canned Fish and Oysters	8,788,104	$22,401,004
Salmon (No. 1 size cans)	1,513,300	8,712,695
California	40,430	241,335
Oregon	376,492	2,314,771
Washington	1,096,366	6,156,558
All other States	12	31
Sardines (No. ¼ size cans)	5,012,199	6,238,933
California	302,736	368,420
Maine	4,634,424	5,780,857
Massachusetts	75,027	89,596
All other States	12	60

*Trans. of the American Fish. Soc., for Dec., 1918. Vol. XLVIII, No. 1.

FISHERY PRODUCTS CANNED IN 1914*—CONTINUED

PRODUCTS AND STATES	CASES	VALUE
Oysters (No. 1 size cans)	944,639	2,676,951
California	24,870	170,946
Florida	16,172	48,657
Georgia	35,902	79,193
Louisiana	78,516	237,425
Maryland	433,440	1,177,091
Mississippi	196,047	526,106
North Carolina	33,795	76,680
South Carolina	118,416	324,405
Virginia	7,429	35,200
All other States	52	1,248
Shrimp (No. 1 size cans)	459,877	1,725,621
Georgia	26,014	109,494
Louisiana	162,005	644,132
Mississippi	266,021	954,535
All other States	5,837	17,460
Tuna (No. ½ size cans)	437,090	1,638,675
California	437,090	1,638,675
Clams (No. 1 size cans)	185,186	670,363
Florida	6,197	26,884
Maine	94,813	270,580
Oregon	11,690	40,828
Virginia	14,874	83,068
Washington	53,000	239,716
All other States	4,612	9,287
Clam Bouillon (No. 1 size cans)	45,214	80,867
Florida	30,960	65,704
All other States	14,254	15,163
Clam Chowder (No. 3 size cans)	102,838	386,998
Florida	11,067	44,300
Maine	86,771	320,198
North Carolina	5,000	22,500
All other Canned Fish	87,761	269,901
All other States	87,761	269,901

In 1914 the Alaska canned fishery pack was as follows: Salmon, 4,056,653 cases; trout, 141 cases; clams, 60 cases. All were reduced to cases of 48 one-pound cans each.

Since this report was prepared there has been a very great increase in fishery products canned, as will be noted by comparing the following figures showing the Pacific coast packs in 1917 with the Federal figures for 1914: Washington—Salmon, 2,152,487 cases; clams, 38,626 cases; crabs, 9,957 cases; grayfish, 5,965 cases; shad, 1,008 cases; ling and rock cod, 21 cases; whale, 250 cases. Oregon—Salmon, 466,829 cases; crabs, 25 cases; shad, 3,411 cases. California—Salmon, 25,773 cases; herring, 112,651 cases; grayfish, 67 cases; shad, 19,630 cases; shad roe, 4,418 cases; yellowtail, 1,501 cases; bonito, 1,844 cases; mackerel, 5,542 cases; tuna, 560,000 cases; sardines, about 1,500,000 cases. A grand total of 4,910,005 cases. The 1917 pack figures for Alaska are as follows: Salmon, 5,922,320 cases; clams, 49,923 cases; herring, 49,897 cases; trout, 1,064 cases; codfish, 2,536 cases. All the above products have been reduced to a common basis of 48 one-pound cans to a case.

During the year ended March 31, 1917, the Dominion of Canada prepared the following packs of canned fishery products: Salmon, 995,198 cases; lobsters, 197,751 cases; haddock, 15,827 cases; herring, 17,159 cases; sardines, 153,680 cases; clams, 17,195 cases; tomalley, 168 cases.

*The quantities of the several classes of products have been reduced to standard cases of the following capacities: Sardines, No. ¼ cans, 48 to the case; tuna fish, No. ½ cans, 48 to the case; salmon, shrimp, oysters and clams, No. 1 cans, 48 to the case; soups, No. 1 cans, 48 to the case; clam chowder, No. 3 cans, 24 to the case.

PRODUCTS PACKED IN TIN*

PRODUCT.	Cans in case.		Net weight of contents of can.		Gross weight of case.		Legal weight of case.		Net weight of contents of case.		Length of case.		Width of case.		Height of case.	
	Number.	Size.	Ounces.	Grams.	Pounds.	Kilos.	Pounds.	Kilos.	Pounds.	Kilos.	Inches.	Centimeters.	Inches.	Centimeters.	Inches.	Centimeters.
Crab meat	48	.....	4	115	24	10.9	19	12 1	12	5 4	12½	31.8	8⅞	22.5	8¾	22 2
Do	24	.....	8	225	22	10.0	17	7.7	12	5 4	15½	39 4	11¼	28.6	5½	14 0
Do	48	.....	8	225	40	18 1	32	14.5	24	10 9	15½	39 4	11⅜	28 6	10	25.4
Crab shells (for serving)	48	.....	4	113	7	3 1	.....	.....	.....	.....	17	43 2	12¼	31 1	11½	5 1
Do	24	.....	8	226	8	3 6	.....	.....	.....	.....	17	43 2	14	35 9	12½	5 6
Tuna	48	.....	3½	99	.....	.....	.....	.....	24	10 9	.....	.....	.....	.....	.....	.....
Do	48	.....	7	199	40	18 1	32	14 5	24	10 9	16	40 7	11½	29.2	11¼	28 6
Do	48	.....	13	368	70	31.8	58	26.3	40	18 4	.....	.....	.....	.....	.....	.....
Oysters	72	.....	3	85	46	20.9	41	18 6	14	6 4	17¼	45 1	11¾	29 8	9¼	23.5
Do	48	.....	4	113	39	17 7	34	15 4	12	5 4	17¾	45.1	11¾	29 8	8½	21.6
Do	48	.....	5	141	46	20 9	41	18 6	15	6.8	17¾	45.1	11¾	29 8	9	22.9
Do	24	.....	6	170	32	14.5	27	12.2	9	4 1	15½	39 6	11¾	28.6	7⅝	19 4
Do	24	.....	8	226	36	16.3	31	14 0	12	5 4	15½	39 6	11¼	28 6	8¾	22.2
Do	24	.....	10	283	42	19.1	37	16.8	15	6 8	17¼	45 1	11¾	29 8	9	22 9
Do	48	tall 1	6	170	49	22 2	44	20 0	18	8 1	17¾	45.1	11¾	29.8	9½	24 1
Do	24	tall 2	12	340	45	20 4	40	18 1	18	8 1	15¼	39 1	11¼	28.6	10½	26.7
Shrimp	48	1	4½	27	28	12 7	21	9 5	14	6.4	17⅞	46.0	11⅞	29.8	9⅛	23 6
Do	24	1½	8½	.....	25	11 3	19	12.1	13	5 9	13½	54 9	10⅜	25 7	7⅞	20 0
Shrimp, dry	48	1	4½	125	28	12 7	22	10 0	15	6 8	17⅞	46 0	11⅞	29 8	9⅛	23.6
Do	24	1½	8½	240	25	11 3	21	9.5	13½	6 1	15½	39.3	11¼	28 6	8¾	22.2
Shrimp, wet	48	1	4½	125	46	20 9	40	18.1	33	15 0	17⅞	4 6	11⅞	29 8	9⅛	23 6
Do	24	1½	8½	240	37	16.8	33	15 0	25½	11 5	15½	39 3	11¼	28 6	8¾	22 2
Salmon	48	tall 1	16	450	69	31.3	60	27.2	48	21.8	20¼	54 0	13	33 0	11⅝	28 3
Do	48	flat 1	16	450	69	31 3	62	28 1	48	21.8	18	45.7	13¼	33.7	11⅜	28.3
Do	48	flat ½	8	225	40½	18 4	41	18 6	24	10 9	16	40 6	11½	29 2	11¼	28 6
Fish flakes	48	½	8	225	42	19 0	34	15 4	24	10 9	18	45 7	12⅛	30 8	7⅛	18 1
Do	48	oz. 12	12	340	72	32 7	60	27 2	36	16 3	15½	39 4	14¾	37.5	10¼	26 4
Sardines	100	4	4	110	55	24 4	46	20 6	25	11 3	23¾	60 3	13¼	33 7	6½	16 5
Do	50	¼	14	340	57	25 8	47	21 3	75	34 0	19⅝	49 9	10⅜	26 4	11 11-16	29 8
Shad roe	48	oval 1	15	425	70	31 8	60	27 2	45	20 4	19⅝	49 9	13¾	34 9	10⅛	25 7
Do	48	oval ½	7½	210	40	18 1	32	14.5	22½	10 2	18¼	46 4	14¾	37.5	5⅞	14.9

*Canned Foods. By A. W. Bitting. Dept. of Com., Bur. of Foreign and Domestic Commerce, Miscell. Series No. 54, pp. 71, 72. 1917.

TO REMOVE THE SKIN FROM A FISH

Sometimes the canner finds it necessary to remove the skin from a fish previous to canning. This is especially necessary when the skin is tough and thick or contains an excess of glue. The skin may readily be removed by putting the fish in boiling water for two or three minutes, when it can be taken off quickly with a pair of pincers.

TIME REQUIRED TO SOFTEN BONES OF FISHES

In cooking fish the canner not only wants to sterilize the product, but also desires to so soften the bones of the fish that there will be left only a soft, friable, mineral matter that can be eaten along with the meat. With the bones thus softened the flesh is much more acceptable as food; thus, small bony fishes that would be otherwise useless, or fishes of small market value, may be saved, and the larger staple fishes made more attractive.

The time required to soften the bones of fishes varies with the species, the size of the fish and the pressure and temperature employed. In canning, unless the required time is known, time and fuel may be wasted by overcooking, or by insufficient cooking the bones may not be properly softened. The bones of fish, properly softened as they are by commercial canning, render available an abundant amount of calcium in acceptable form, not encountered in such amounts in any other common food. In addition to this they supply phosphoric acid and other valuable minerals. It is estimated that 8-10th grams of calcium oxide is a necessary daily requirement of the average adult.

The U. S. Bureau of Fisheries* "has conducted experiments to determine the time required to soften the bones of about 30 common marine and freshwater fishes of different sizes. In the table which follows the time given is that determined experimentally for the sizes mentioned. It will be a simple matter to interpolate the time periods required to soften the bones of fishes of the same species but of sizes different from those represented. The term 'softening,' as here used, means the point in cooking when the small bones, ribs, etc., are soft, but when the large vertebrae are not yet sufficiently soft to be consumed along with the muscle. In some of the larger fishes whose large bones could scarcely be eaten, even if they were softened, it would appear to be a waste of time and fuel to carry them to the point of complete cooking, and in such cases it ought to be sufficient to soften the small bones and sterilize the contents of the can. For such a purpose the 'softening' rather than the 'soft' point may be used.

"These experiments refer to fish cooked in Mason glass jars of quart size. The time periods are measured from the point when the given pressure and temperature are reached (at the top of the cooker) to the time when the heat is shut off. The heating-up and cooling-off periods of time are thus not included. The fish were salted, but no water is added. Samples of fish canned during the course of these experiments were kept for six weeks at room temperature (about 68° F.) and were then incubated at 98° for 48 hours. All were sterile.

*Rep. U. S. Com'r. of Fish., 1918, pp. 35, 36, 1918.

TIME REQUIRED TO SOFTEN THE BONES OF VARIOUS SPECIES OF FISH, 10 POUNDS PRESSURE, 240° F.

SPECIES	Weight	Softening	Soft
	Lbs.	Mins.	Mins.
Black Bass:			
Large	5-6	100	120
Small	¾-1	100	110
Bluefish:			
Large	6-9	90	100
Small	1-2	80	90
Butterfish, medium	1¼-1½	60	80
Carp	8-12	110	120
Catfish:			
Large	1½-2	70	80
Small	¾	60	70
Cero, medium	10-13	80	90
Cod:			
Large	6-16	80	90
Small	1-2	50	60
Croaker:			
Large	¾-1	90	100
Small	1¼-1½	50	60
Eel	2-3½	100	110
Flounder:			
Large	1-1¾	70	80
Small	½-1	50	60
Haddock:			
Medium	3-5	60	70
Small	1-2	50	60
Halibut, medium	50-90	70	80
Hickory shad, medium	1½-2	60	70
Hogfish	¼	50	60
Kingfish, medium	½-1	60	70
Lemon Sole:			
Large	2½-3½	80	90
Small	¾-2	60	70
Mackerel, medium	¾-1½	60	70
Mackerel, Spanish, medium	1½-2½	100	110
Perch, white, medium	¼-¾	100	110
Perch, yellow, medium	¼-¾	90	100
Pollock, medium	5-7½	60	70
Salmon, medium	13-19	90	100
Sea Bass, medium	1-1½	60	70
Shad	5½	90	100
Smelt:			
Large	(a)	60	70
Small	(b)	50	60
Snapper, Red:			
Large	10-15	110	120
Small	5-6	90	100
Squeteague:			
Large	2¼-4	80	90
Medium	2	60	70
Small	¾-2	50	60
Striped Bass:			
Large	10-15	110	120
Small	¾-1½	70	80
Sucker, medium	½-1½	80	90
Tilefish, medium	6-12	90	100
Whiting, medium	½-1	50	60

(a)—From 5 to 7 to the pound. (b)—From 15 to 20 to the pound.

TEMPERATURE EQUIVALENTS

FAHRENHEIT—CENTIGRADE—REAUMUR

F. Degrees.	C. Degrees.	R. Degrees.	F. Degrees.	C. Degrees.	R. Degrees.
200	93.34	74.66	228	108.89	87.11
201	93.89	75.11	229	109.45	87.55
202	94.45	75.55	230	110	88
203	95	76	231	110.56	88.44
204	95.56	76.44	232	111.11	88.88
205	96.11	76.88	233	111.67	89.33
206	96.67	77.33	234	112.23	89.77
207	97.23	77.77	235	112.78	90.22
208	97.78	78.22	236	113.34	90.66
209	98.34	78.66	237	113.89	91.11
210	98.89	79.11	238	114.45	91.55
211	99.45	79.55	239	115	92
212	100	80	240	115.56	92.44
213	100.56	80.44	241	116.11	92.88
214	101.11	80.88	242	116.67	93.33
215	101.67	81.33	243	117.23	93.77
216	102.23	81.77	244	117.78	94.22
217	102.78	82.22	245	118.34	94.66
218	103.34	82.66	246	118.89	95.11
219	103.89	83.11	247	119.45	95.55
220	104.45	83.55	248	120	96
221	105	84	249	120.56	96.44
222	105.56	84.44	250	121.11	96.88
223	106.11	84.88	255	123.89	99.11
224	106.67	85.33	260	126.67	101.33
225	107.23	85.77	265	129.45	103.55
226	107.78	86.22	270	132.23	105.77
227	108.34	86.66			

TIN PLATE

TIN PLATE	Thickness Stubs' Gauge	No. of Sheets in Box	Net Weight of Box 14x20 Sheets
Taggers	38 (34)	225 (150)	112 lbs.
IC	30	112	107 lbs.
IX	28	112	135 lbs.
IXX	27	112	156 lbs.
IXXX	26	112	176 lbs.
IXXXX	25	112	196 lbs.

COMPOSITION OF FISH, MOLLUSKS, CRUSTACEANS, ETC.*

KIND OF FOOD MATERIAL.	Refuse (bone skin, etc.)	Salt.	Water.	Protein by factor (N×6.25)	Fat.	Carbohydrates.	Ash or mineral matter.	Total nutrients.	Fuel value per pound.
FRESH FISH	Per Ct.	Per Ct.	Per Ct.	Per Ct.	Per Ct.	Per Ct.	Per Ct.	Per Ct.	Calories
Alewife, whole	49.5		37.6	9.8	2.4		0.8	13.0	277
Bass, large-mouthed black, dressed	46.7		41.9	10.3	.5		.6	11.4	209
Bass, large-mouthed black, whole	56.0		34.6	8.5	.4		.5	9.4	172
Bass, small-mouthed black, dressed	46.4		40.1	11.7	1.3		.7	13.7	263
Bass, small-mouthed black, whole	53.6		34.7	10.1	1.1		.6	11.8	227
Bass, sea, dressed	46.8		42.2	10.5	.2		.7	11.4	200
Bass, sea, whole	56.1		34.8	8.7	.2		.6	9.5	168
Bass, striped, dressed	51.2		37.4	8.8	2.2		.5	11.5	249
Blackfish, dressed	55.7		35.0	8.4	.5		.5	9.4	172
Bluefish, dressed	48.6		40.3	10.0	.6		.7	11.3	204
Butterfish, dressed	34.6		45.8	11.8	7.2		.7	19.7	503
Butterfish, whole	42.8		40.1	10.3	6.3		.6	17.2	440
Carp (European analysis)	37.1		48.4		7		.9	14.5	263

*Fish as Food. By C. F. Langworthy. (Rev. 1907.) U. S. Dept. of Agric., Farmers' Bull. No. 85, pp. 10-13. 1907.

COMPOSITION OF FISH, MOLLUSKS, CRUSTACEANS, ETC.—CONTINUED

KIND OF FOOD MATERIAL.	Refuse (bone skin, etc.)	Salt.	Water.	Protein by factor (N × 6.25)	Fat.	Carbohydrates.	Ash or mineral matter.	Total nutrients.	Fuel value per pound.
FRESH FISH—Continued	Per Ct.	Per Ct.	Per Ct.	Per Ct.	Per Ct.	Per Ct.	Per Ct.	Per Ct.	Calories
Cod, dressed	29.9	.....	58.5	11.1	0.2	.....	0.8	12.1	209
Cod, steaks	9.2	.....	72.4	17.0	.5	.....	1.0	18.5	327
Cusk, dressed	40.3	.....	49.0	10 1	.1	.....	.5	10.7	186
Eel, salt-water, dressed	20.2	.....	57.2	14.8	7.2	.....	.8	22.8	558
Flounder, common, dressed	57.0	.....	35 8	6.4	.3	.....	.6	7.3	127
Flounder, winter, dressed	56.2	.....	37.0	6.3	.2	.....	.5	7.0	122
Hake, dressed	52.2	.....	39.5	7.3	.3	.....	.5	8.1	145
Haddock, dressed	51.0	.....	40.0	8.4	.2	.....	.6	9.2	159
Halibut, dressed	17.7	.....	61.9	15.3	4.4	.....	.9	20.6	454
Herring, whole	42.6	.....	41.7	11 2	3.9	.....	.9	16.0	363
Mackerel, dressed	40.7	.....	43.7	11.6	3.5	.....	.7	15.8	354
Mackerel, Spanish, dressed	24.4	.....	51.4	16.3	7.2	.....	1.2	24.7	585
Mackerel, Spanish, whole	34.6	.....	44 5	14.1	6 2	.....	1 0	21.3	508
Mullet, dressed	49.0	.....	38.2	9.9	2.4	.....	.6	12.9	277
Mullet, whole	57.9	.....	31.5	8.2	2 0	.....	.5	8.9	231
Perch, white, dressed	54.6	.....	34.4	8.8	1.8	.....	.5	11.1	231
Perch, white, whole	62.5	.....	28.4	7.3	1.5	.....	.4	9 2	195
Perch, yellow, dressed	35 1	.....	50.7	12.8	.7	.....	.9	14.4	259
Pickerel, dressed	35.9	.....	51.2	12.0	.2	.....	.7	12.9	227
Pickerel, whole	47.1	.....	42.2	9.9	.2	.....	.6	10.7	186
Pollock, dressed	28.5	.....	54 3	15.4	.6	.....	1.1	17.1	304
Pompano, whole	45.5	.....	39.5	10.3	4.3	.....	.5	15.1	358
Porgy, dressed	53.7	.....	34.6	8.6	2.4	.....	.7	11.7	254
Porgy, whole	60.0	.....	29.9	7.4	2.1	.....	.6	10.1	218
Red Grouper, dressed	55.9	.....	35.0	8.5	.2	.....	.5	9.2	163
Red snapper, dressed	45.3	.....	43.7	10.6	.3	.....	.7	11.6	204
Salmon, California (sections)	10.3	.....	57.9	16.7	14.8	.....	.9	32.4	903
Salmon, Maine, dressed	23.8	.....	51.2	15.0	9.5	.....	.9	25.4	658
Shad, dressed	43.9	.....	39 6	10.6	5.4	.....	.8	16 8	408
Shad, whole	50.1	.....	35.2	9.4	4.8	.....	.7	14 9	363
Shad, roe	.....	.....	71.2	23 5	3.8	.....	1.5	28.8	581
Smelt, whole	41.9	.....	46.1	10.1	1.0	.....	1 0	12.1	222
Sturgeon, dressed	14 4	.....	67.4	15 1	1.6	.....	1 2	17 9	340
Tomcod, dressed	51 4	.....	39 6	8.4	.3	.....	.5	9.2	163
Tomcod, whole	59.9	.....	32.7	6.9	.2	.....	.4	7.5	132
Trout, brook, dressed	37.9	.....	48.4	11.9	1.3	.....	.7	13.9	268
Trout, brook, whole	48.1	.....	40.4	9.9	1.1	.....	.6	11.6	222
Trout, lake, dressed	37.5	.....	44.4	11.0	6 2	.....	7	17.9	449
Turbot, dressed	39.5	.....	43.1	8.9	8.7	.....	.8	18.4	513
Turbot, whole	47.7	.....	37.3	7.7	7.5	.....	.7	15.9	445
Weakfish, dressed	41.7	.....	46.1	10.4	1.3	.....	.7	12.4	240
Weakfish, whole	51 9	.....	38.0	8 6	1.1	.....	.6	10 3	200
Whitefish, dressed	43.6	.....	39.4	12.8	3 6	.....	.9	17.3	376
Whitefish, whole	53.5	.....	32.5	10.6	3.0	.....	7	14.3	313
General average of fresh fish as sold	41.6	.....	44.6	10.9	2.4	.....	.7	14.0	295
PRESERVED FISH									
Mackerel, No. 1, salted	19.7	8 3	34.8	13 9	21.2	.....	2 1	37.2	1,107
Cod, salted and dried	24.9	17.3	40.2	19 0	.4	.....	1 2	20.6	363
Cod, boneless codfish, salted and dried	.....	21.5	54.4	26 3	.3	.....	1.7	28.3	490
Caviar	.....	.....	38.1	30.0	19.7	7.6	a4 6	61.9	1,479
Herring, salted, smoked and dried	44.4	6.5	19.2	20 5	8.8	.....	.9	30.2	726
Haddock, salted, smoked and dried	32.2	1.4	49.2	15 8	.1	.....	1.0	16.9	290
Halibut, salted, smoked and dried	7.0	12.0	46.0	19.3	14.0	.....	1.9	35 2	916
Sardines, canned	5.0	.....	53.6	23 7	12.1	.....	5 3	41.1	916
Salmon, canned	14.2	.....	56.8	19 5	7.5	.....	a2.0	29.0	658
Mackerel, canned	.....	1.9	68.2	19.6	8.7	.....	1.3	29.6	708
Mackerel, salt, canned	19.7	8.3	34 8	13.9	21.2	.....	2.1	37.2	1,107
Tunny, canned	.....	.....	72.7	21.7	4.1	.....	1.7	27.5	558
Haddock, smoked, cooked, canned	.....	5 6	68.7	22.3	2.3	.....	1 6	26.2	499
MOLLUSKS									
Oysters, solids	.....	.....	88.3	6.0	1.3	3.3	1.1	11.7	222
Oysters, in shell	81.4	.....	16.1	1.2	.2	.7	.4	2.5	41
Oysters, canned	.....	.....	83.4	8.8	2.4	3.9	1.5	16.6	327
Scallops	.....	.....	80.3	14.8	.1	3.4	1.4	19.7	336
Long clams, in shell	41.9	.....	49.9	5.0	.6	1.1	1.5	8.2	136
Long clams, canned	.....	.....	84.5	9.0	1.3	2.9	2.3	15.5	268

COMPOSITION OF FISH, MOLLUSKS, CRUSTACEANS, ETC.—CONTINUED

KIND OF FOOD MATERIAL.	Refuse (bone skin, etc.)	Salt.	Water.	Protein by factor (N × 6.25)	Fat.	Carbohydrates.	Ash or mineral matter.	Total nutrients.	Fuel value per pound.
MOLLUSKS—Cont.	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.	Calories
Round clams, removed from shell	.....	.....	80 8	10 6	1 1	5 2	2 3	19 2	331
Round clams, in shell	67 5	.....	28 0	2.1	1	1 4	.9	4 5	68
Round clams, canned	.....	.....	82 9	10 5	.8	3 0	2.8	17 1	277
Mussels	46 7	.....	44 9	4.6	.6	2.2	1 0	8.4	150
General average of mollusks (exclusive of canned)	59.4	.....	34 7	3.2	.4	1.4	.9	5 9	99
CRUSTACEANS.									
Lobster, in shell	61 7	.....	30 7	5 9	.7	.2	.8	7 6	141
Lobster, canned	.....	.....	77.8	18 1	1 1	.5	2 5	22 2	381
Crawfish, in shell	86.6	.....	10 9	2.1	1	.1	.2	2 5	45
Crabs, in shell	52 4	.....	36 7	7 9	.9	.6	1 5	10 9	191
Crabs, canned	.....	.....	80 0	15 8	1 5	.7	2 0	20 0	358
Shrimp, canned	.....	.....	70 8	25 4	1 0	.2	2 6	29 2	503
Fresh abalone	.....	.....	72 8	22 2	.3	3 3	1.4	27.2	501
Canned abalone, flesh	.....	.....	73 2	21 7	1	3 7	1 3	26 8	489
Canned abalone, liquid in can	.....	.....	93.8	4 4	1	.2	1.5	6 2	93
Dried abalone	.....	.....	39 7	36 0	.5	20.9	2.9	60 3	1,079
General average of crustaceans (exclusive of canned and dried)	50.2	.....	37 8	9 5	.5	1.0	1.0	12.0	220
TERRAPIN, TURTLE, ETC.									
Terrapin, in shell	75.4	.....	18.3	5 2	.9	.....	.2	6 3	132
Green turtle, in shell	76 0	.....	19 2	4 7	.1	.....	.3	5.1	91
Average of turtle and terrapin	75 6	.....	18 8	4 9	.5	.....	.3	5.7	111
Frogs' legs	32 0	.....	56 9	10 5	.1	.....	.7	11 3	195
General average of fish, mollusks, crustaceans, etc	45 0	.....	42 3	9 7	2 1	.2	.7	12 7	264
OTHER ANIMAL FOODS									
Beef, side, medium fat	17.4	.....	49 4	14 8	18.1	.....	.7	33 6	998
Veal, side	22.6	.....	55 2	15 6	6.3	.....	.8	22 7	535
Mutton, side	19 3	.....	43 3	13 0	24 0	.....	.7	37 7	1,207
Average of beef, veal, and mutton	19.4	.....	49 3	14.5	16 1	.....	.7	31.3	913
Pork, side	11 2	.....	26 1	8.3	54 8	.....	.4	63 5	2,363
Chicken	25 9	.....	47 1	13 7	12 3	.....	7	26.7	744
Turkey	22 7	.....	42 4	16.1	18 4	.....	.8	35.3	1,034
Milk	..	.....	87.0	3.3	4 0	5 0	.7	13 0	313
VEGETABLE FOODS									
Wheat flour	.....	.....	12 0	11.4	1.0	75 1	.5	88 0	1,610
Corn meal	.....	.....	12.5	9 2	1 9	75 4	1.0	87.5	1,610
Wheat bread (from patent flour)	.....	.....	35 3	9 2	1.3	53 1	1.1	64 7	1,215
Beans, dried	.....	.....	12 6	22.5	1 8	59 6	3 5	87.4	1,560
Potato	20 0	.....	62 6	1.8	.1	14 7	.8	17.4	303
Cabbage	15 0	.....	77 7	1 4	.2	4 8	.9	7 3	122
Corn, canned	.....	.....	76 1	2 8	1.2	19 0	.9	23 9	445
Salad greens	.....	.....	86 7	4 2	.6	6 3	2.2	13 3	213
Apples	25 0	.....	63 3	3	.3	10 8	.3	11 7	213
Bananas	35 0	.....	48 9	.8	.4	14 3	.6	16 1	290
Strawberries	5 0	.....	85.9	.9	.6	7.0	.6	9.1	168
Sugar	.....	.....	.....	.....	.....	100 0	.....	100.0	1,860

[a] Including salt.

"In several cases the analysis of fish, whole and dressed is given. Usually the composition of the dressed fish was computed from that of whole fish with the aid of the figures for loss of weight in dressing for market, mentioned on page 7."

"In a number of cases cited in the table above more than one specimen was analyzed, although only the averages are given in the table. In such cases the samples showed more or less variation in total nutrients, but the variation was due more especially to the fats. Thus the fat in the flesh of seven specimens of shad ranged from 6.5 to 13.6 per cent., in fresh mackerel from 2.2 to 16.3 per cent., and in fresh halibut from 2.2 to 10.6 per cent. The protein and ash or mineral matter remained practically the same in all the specimens where the wide fat variation was noticeable, an increase of fat being accompanied by a decrease of water."

GUARANTY CLAUSE IN CONTRACT

The National Canners' Association, under date of October 16, 1915, issued the following important announcement with respect to a proper guaranty clause to be inserted in selling contracts made by its members, and it behooves all packers of fishery products to study this well and incorporate such clause in their contracts:

"The Baltimore Canned Goods Exchange has for some time had under consideration the question of a proper guaranty clause, and at its meeting on Tuesday, the 12th inst., endorsed the form adopted by the National Canners' Association at the Baltimore convention in February, 1914, as the same had been agreed upon by the conference committee of that association, with a similar committee from the National Wholesale Grocers' Association. This form reads as follows:

'I (we) the undersigned do hereby warrant and guarantee that articles of food and drugs which the undersigned has sold, or shall at any time hereafter prepare or manufacture for, or sell or deliver to ..... do and will comply with the United States Pure Food and Drugs Act, June 30, 1906, and all amendments thereto, and are not and shall not be adulterated nor misbranded within the meaning of the said act and amendments, and that they conform also to the food laws of the state to which I (we) ship them.

'However, if the guarantor shall use labels furnished by the buyer under specific labeling instructions, said guarantor shall not be responsible to the buyer for misbranding, but guarantees only that the contents comply with said food laws.

'This shall be a continuing guaranty until notice of revocation shall be given in writing. Notice of acceptance of this guaranty hereby waived.

'Dated at ..... this ..... day of ..... 19.....

.....

(Sign in ink)

.....

(Full address)'

"After the adoption of this form of guaranty, F. I. D. No. 153 was issued on the 5th day of May, 1914, and was published in Bulletin No. 24, under date of May 18, 1914.

"F. I. D. No. 153 repealed and re-enacted Regulation No. 9 for the enforcement of the Food and Drugs Act, June 30, 1906, and required that the guaranty should be incorporated in or attached to the bill of sale, invoice, bill of lading or other schedule, giving the names and quantities of the article or articles sold, and should not appear on the labels or packages.

"After the issuance of F. I. D. No. 153, the matter of a proper form of guaranty for insertion in contracts intended to be signed by the seller, was submitted to our legal department, and the following form for that purpose was suggested, namely:

" 'The seller hereby guarantees that the articles of food sold under this contract are not adulterated or misbranded within the meaning of the act of Congress known as the Food and Drugs Act, June 30, 1906, and the amendments thereof now in force and the laws of the state where the buyer is located and within the meaning of the laws of the state of....., where said goods are produced; but this guaranty does not include the misbranding of goods sold under buyer's labels.'

"This form contains the elements of the guaranty adopted by the Baltimore convention adapted to the requirements of F. I. D. No. 153."

INSPECTION BY NATIONAL CANNERS ASSOCIATION

At its annual meeting in 1919 the National Canners' Association decided to inaugurate inspection, wherever possible, in 1919. To this end the committee appointed met at Washington City on February 28 and March 1 and took the following action:

Inspection This Year

1. Wherever possible, the several canning states now considering the plan of inspection, to perfect their organization in time for the 1919 pack.

2. The plan of Inspection to contemplate:

(a) An inspection as to sanitation.

(b) An inspection as to quality of raw material and standards of finished products. The work of sanitary inspection to begin with the new pack. The work of Inspection for quality of standards to begin as soon as the several sections shall have approved the definitions of such standards, and submitted them to and have them approved by the Joint Committee on Definitions and Standards of the Bureau of Chemistry of the Department of Agriculture.

Sanitary Regulations

3. The sanitary rules and regulations adopted in 1914 by the National Canners' Association, as revised by this committee at its session on March 1st, copy of which is herewith attached, shall be the basis for sanitation throughout the several canning states, provided, however, that they shall be made to conform to all the state and Federal regulations as to sanitation, including state regulations as to plumbing.

Standards of Quality

As to standards of quality and definitions of grades, the committee directed the chairman *pro tem* to announce that the definitions and standards for canned peas, as promulgated by the U. S. Department of Agriculture, February 15th, 1918, should govern the canning of peas. As to definitions and standards for canned corn, tomatoes and other products, the chairman *pro tem* was directed to refer the formulation of such standards and definitions to the several sections, and request that the section chairmen appoint suitable committees to prepare such definitions and standards, and refer the same to an early meeting of sections for their approval.

Certificate of Inspection

5. The chairman was authorized to appoint a committee to recommend a suitable certificate of approval, to embody a design which would be adopted as a national emblem, said committee to work in co-operation with Mr. Gorrell. The committee appointed was as follows: Mr. Cobb, New York; Mr. Strasbaugh, Maryland; Mr. Witwer, Iowa.

Chemical Laboratories

It was agreed to make the following recommendations to the advisory committees of the several canning states:

1. That chemical laboratories be established in the office of each chief inspector, and that the chief inspector should be a professional chemist.

2. That each state immediately employ a competent person to visit the canners, and secure their signature to the contract covering the plan of inspection, the expense of such organizer to be charged as a part of the expense of operations for the first year.

The committee adopted the following rules and regulations for sanitary inspection of canneries:

RULES AND REGULATIONS ADOPTED BY NATIONAL COMMITTEE ON INSPECTION

Factories preparing food products shall be located so as to be able to receive and distribute their products promptly, without danger of damage or deterioration, and shall not be located in the immediate vicinity of any other industry which may be objectionable because of noxious odors given off, or because of the use of decomposed products.

No food factory shall be located in an unsanitary place, or one which cannot be made sanitary, or maintained in a sanitary condition.

No food factory shall be located where the refuse from the plant cannot be disposed of in a sanitary manner, and not of itself become a nuisance to the factory.

No litter, waste, refuse or decomposed products shall be allowed to accumulate in or around the buildings or yards. All liquid waste shall be conducted from the building by means of suitable drains. Gross by-products suitable for other usage, as pea vines, or corn husks, may be stacked or placed in silos separate from the building, and must be properly drained. Other by-products may be retained only if rendered unobjectionable. Raw tomato skins, cores, etc., shall not be permitted to be piled near the factory.

All buildings used for the manufacture of food products shall be clean, properly lighted and ventilated. The ceilings shall be of sufficient height to permit ample clearance for all work under any suspended shafting, hangers, pipings, galleries, etc. Where natural light and ventilation is insufficient, provision must be made for augmenting the same by mechanical methods. The interiors of all working rooms shall be kept a light color by paint, whitewash or other suitable method.

The floors of all rooms used for manufacturing should be watertight, and pitched enough to carry all waste to the sewers. Gratings should be provided around cookers, washers and at other places where overflow is unavoidable.

All scalders, blanchers and tanks of water in which a product is held—as tomatoes before scalding, and peaches and pears before filling into the cans, shall be provided with a continuous fresh supply and an overflow.

No cans shall be brined or syruped by passing through a tank to receive the brine, syrup or water, by submergence—"dip tank."

All tables, pails, pans, trays, utensils, conveyors, machines, floors, etc., shall be cleaned with steam and water at the close of each day, and as much oftener as is necessary to prevent souring or unsanitary conditions. There shall be ample water and steam supply to keep the factory clean.

Roadways about the factory shall be sprinkled, oiled or otherwise treated to prevent dust.

Only potable water shall be used in making syrup, or brine, or in washing equipment coming in contact with food.

Cans must be washed immediately before being filled.

All fruits and vegetables shall be washed before canning.

Toilet rooms must be maintained, and where different sexes are employed they must be separate for each sex, plainly and distinctly marked, and to be used only by the sex designated.

Toilet rooms, including the walls, floors, ceilings and all fixtures, must be kept clean and provided with sanitary paper.

Toilet rooms must be open to outside light and air, and be of sufficient size and equipment for the number of people employed.

Where toilet rooms are in the factory they must be supplied with proper flushing appliance and connected with a sewer.

Outside closets must be sufficiently removed from the factory to avoid being a nuisance, and built tight above the ground. The doors constructed to remain closed, and the buildings properly ventilated, lighted and screened. The vault to be kept thoroughly disinfected, and cleaned when filled to level with the ground.

Wash rooms must be provided, conveniently located, and of sufficient size and equipment for the accommodation of all employees and separated for sexes, equipped with running water, and provided with individual or sanitary towels and plenty of soap.

Sanitary drinking fountains shall be conveniently placed for employees and common drinking cups prohibited.

Where a change of clothes for work is necessary, dressing rooms must be provided, and hangers or lockers provided for street clothes.

No persons afflicted with infectious or contagious disease or infected wounds shall be employed in a factory preparing or canning food.

Employees are prohibited from using tobacco and from spitting on the floors.

Employees must be properly clothed for the work to be done.

Employees shall keep the finger nails clean and short, and wash their hands before commencing work and after each absence from the room.

Any dispute between an inspector and a canner, relative to these rules and regulations, shall be referred to the chief inspector of each state, it being understood, however, that the canners shall have the right to appeal from any decision of the chief inspector to the National Canners' Association.

SOME SAFETY MEASURES IN CANNERIES

In 1914 the National Canners' Association issued a report by Dr. A. W. Bitting, of the Association's research laboratories, on the responses received to a letter of inquiry sent to the various packers as to the frequency and character of accidents occurring in canneries. As a result of a study of these reports Dr. Bitting recommends certain preventative measures as noted below. The inspecting of boilers, steam pipe lines, etc., guarding of dynamos and motors, insulating of electric wiring and switches, etc., have been purposely omitted by Dr. Bitting.

Burns

"The most frequent accidents reported are burns, or scalds, due to exposed steam pipes, exhaust boxes, retorts, and to escaping steam from cookers, etc.

"Where steam pipes enter exhaust boxes, retorts or jacketed-kettles, or are exposed within reach of employees, they should be protected or insulated. It does not follow that the whole steam pipe system should be insulated, though this may be an economy, but those portions which may be reached or which are likely to be struck by the hand or arm, should be protected. This may be done by the regular insulating material, by boxing with wood, or by covering with wire netting. Pipes out of ordinary reach, but which might be taken hold of at some time, should be painted red or other distinctive color, as a danger signal.

"The uncovered galvanized iron exhaust box is the cause of a rather unexpectedly large number of burns, due to two reasons: First, unwittingly placing the hand on some part; and, second, trying to relieve a choked condition too soon after turning off the steam. Some exhaust boxes are covered with wood to avoid the unnecessary radiation of heat and thus overcome, in part, the first criticisms. These boxes can be guarded by railing along the sides but more effectively by frames of wire netting, set a couple of inches from the sides and covering the portion of the top that may be reached, and also by painting them red to call attention to the danger. The burns due to removing chokes can only be avoided by using ordinary intelligence and delaying action until the box has cooled to a point of safety. The same precautions should be used to protect against burns from pea blanchers. The burns from pipes, exhaust box and blanchers are usually minor in character, involving the finger tips, hands or some part of the arm. They are usually painful, but ordinarily do not incapacitate from work. The burns occurring from the retort and process tanks are for the most part due to personal carelessness, as opening the retort before the blow-off has been completed, and hoisting the crate out with a jerk, causing scalding water to be thrown upon the helper or slopped or splashed upon the floor. Burns from these causes can only be averted by careful superintendence.

Test the Retorts

"There are other accidents, however, of serious character, that demand safety devices. The inquiry shows that on an average, at least one retort blows up each year. With each one there is the possibility of either the loss of life or serious burns, and these have happened several times. First of all, the retort should be thoroughly inspected at regular intervals for safety, and this should include a hydrostatic test of at least ten pounds above the working pressure. The safety valves should be lifted each day. If the steam pressure is not automatically controlled there should be a reducing valve in the main line to hold the pressure below the safety limit. Hand control of temperature has a human element of forgetfulness, and although the operation may be carried out faith-

fully many hundreds of times, there is the possibility of relaxation. The automatic controller adds a distinct element of safety as well as insuring more uniform cooking. The fact that there has been only an occasional explosion attests more to the care exercised in building retorts than that in their actual operation.

"The blowing out of gaskets is occasionally the cause of a burn, and for the most part can be avoided by the same precautions already cited. The direction of the blow-off, vent valve, etc., are details that need only to be called to one's attention to have the discharge of steam turned in such a direction as not to strike an employe. One precaution which should accompany an installation of retorts or cookers, is that the floor should be made to slope toward the cooker for a distance of two feet or more, and that it should be covered with a grating. This is for the purpose of holding any hot water which may be thrown out in boiling or in hoisting crates of cans.

"The long open bath, such as the Dixon cooker, should be guarded at the sides to prevent any one from falling in. This may appeal to some canners as being absurd, but the records show both loss of life and limb from neglect of this precaution. This can be done by frames which can be raised and lowered without interfering with any working operation.

In Preserving Plants

"Burns from preserve or syrup kettles are usually due to splashing of contents in boiling. This may be avoided, in a large measure, on small kettles by using cylinders of the same diameter as the kettle and about one foot in height. These cylinders are attached to a pulley and raised and lowered in position when needed. They have proven to be very effective in the factories where used.

"The jacketed preserve-kettle, like the retorts and boilers, should be inspected at intervals by an engineer. Each kettle should have its own safety valve and these should be opened daily to insure against sticking.

"A number of burns were also reported from the dipping of the capping steel or soldering copper in the acid can. These burns have been small and occurred on the back of the hands or on the face. They have been accompanied by unusual scarring; one report in particular states that a small burn below the lower eye caused a cicatrix and permanent disfiguration, and others as leaving unusually prominent marks. A protector against such accidents is to place a shield of tin above and on the near side of the acid can. Burns from the gas or gasoline firepots and capping machines seem to be of rare occurrence.

"The attention to all small burns may seem to be trivial, too trivial for some superintendents and cannery operators. If they are trivial, it will take only a few minutes to cleanse the parts and to give a proper dressing, the healing then being only a matter of a very short time. But trivial burns are prone to become infected from neglect and cause scars, or disfigurement, or to become infected with erysipelas and sepsis or pus. One 'trivial' burn in the palm of the hand became septic and necessitated the amputation of an arm. All serious burns should receive the immediate attention of a physician.

Shifting and Guarding Belts

"The most serious accidents have been due to placing belts on moving pulleys instead of waiting for the machinery to stop. Broken arms, legs, wrists, mashed fingers and hands, being violently thrown and injured, clothes caught and pulled or torn off, are in the records. In most cases the attempt at replacement was made by someone operating a machine who was not familiar with such work and sometimes contrary to orders of

the superintendent. Such accidents cannot be avoided by safety devices, but should be prevented by requiring that the machines be brought to a stop, or if permitted to move, it should be very slowly and under control, and that the belt be replaced by the superintendent or mechanic. The work of the factory is never so urgent that time cannot be taken to make a stop long enough to replace a belt safely, rather than with risk of an injury.

"No line or countershaft should be so low that the pulleys or belts can be reached in the performance of any usual operation in the factory. In the case of shafting bearing a number of pulleys, there should be a suspended platform from which to make adjustments, to repair and replace belts, and to do the oiling. This is much safer than working from ladders and in the end also proves an economy in time saving. An essential feature of this staging should be a hand rail.

"The collar with exposed set-nut continues to find victims. The records against this small piece of apparatus are such that it should be a criminal offence to have one in a modern factory. Safety collars cost on an average only from five to ten cents more than the old style, so that the additional cost to an ordinary factory for the best form would not be more than one or two dollars. The losses occasioned by one serious accident would pay for the additional equipment for all the factories in the country. Shaft couplings are minor offenders, as compared with the collar and set screw, but they should be of the type with unexposed nuts or bolt heads.

"Belts should be well guarded where they pass through the floor or where they pass so low or in such a position on a machine that they may be touched by the hand or brushed by the clothing. Where belts pass through the floor they should be completely encased to a height of five feet, the casing being made of wood, metal or strong woven-wire, the mesh being about one-half inch. Where machines have their driving belts near the floor, but the belting from above, similar guards should be provided. Belts or sprocket chains at the end of a piece of apparatus where someone is likely to stand should be guarded, and in most cases these guards can be best attached to the apparatus.

Guards Over Gears

"Similar guards should be placed over gear and worm-driven wheels wherever they come in such a position that it is possible to reach them in any operation. These cases need not be expensive or elaborate affairs, and in most instances can be built by the superintendent or engineer.

"The manufacturers of canning machinery are assisting greatly in this work by changing their designs, not only to secure greater efficiency, but also to comply with suggestions made by the several state factory inspectors. The various machines require individual treatment in guarding against accidents, and some canners have exercised considerable ingenuity in securing the desired result. The accompanying photographs serve to tell the story better than a description.

"The crane or hoist for lifting crates in and out of the vertical retort has given considerable trouble. The hand crane has proven to be the more dangerous, as several cases have been cited where the crank has been whirled around, striking the arm and breaking bones. Some of the home-made affairs have not been equipped even with a ratchet to hold the load, and others are without a friction brake to check the load when the ratchet is raised to permit the load to come to rest, either in the kettle or on the floor. The ratchet and brake are, obviously, essential parts of the hoist, and it is little less than criminal to operate one without them.

"The accidents with electric and steam hoists have been almost wholly attributable to the operator using too great speed—starting and ending the operation with a jerk. The

steam hoist requires rather more care than motor in cold weather, as the action is not smooth until the cylinder is hot. Most of the accidents have been due to splashing scalding water and to dropping loaded crates, causing burns in the first place and occasional mashed toes in the second.

Tram Rails

"The overhead trolley has been the cause of a few accidents, due to running loaded crates through an open switch. These have been in the nature of mashed toes and one fractured ankle. The number of these accidents has been very small, but they suggest that the same device which throws a switch and leaves a rail open might also be made to automatically place a stop in a position at the same time. The number of accidents resulting from the overhead tram rail has been small in comparison with floor trucks, and furthermore, the possibilities of prevention seem to be easier. The accidents from floor trucks are, for the most part, due to carelessness of employees backing or running the trucks into others and to falling over the handle.

Guards

"Guard rails should be placed upon all tramways, and around platforms and around areaways. A properly constructed rail should consist of not only the hand rail at a height of about thirty inches, but also a second a few inches off the floor. This latter is especially desirable wherever a tendency exists for the feet to be carried over the edge in making turns, as in trucking or carrying packages. Elevators should be particularly guarded, as more accidents have been reported occurring there than from the falls from stairs or balconies. The manufacturers of the better class of elevators are able to supply automatic devices for opening and closing gates, or doors, which have been approved by factory and elevator inspectors and are almost certain to be better than an untried appliance. In the absence of automatic guards, the owner should provide lifts or doors which will insure safety.

"It is not usual to place guard rails along the sides of the runway from the car to the warehouse, but this is so easily done that the precaution should not be avoided. Of almost equal importance to the hand rail is a guard about three inches in height to keep trucks from going over the edge. This latter precaution should also be followed when trucking follows inclines or narrow runways.

"A temporary guard should be placed around cellar or trap doors, or openings in the floors, in case these are left open or when making repairs.

Cuts

"Cutting the hands on the edge of tin cans is exceedingly frequent in occurrence. This occurs in handling the cans out of the cars, in transferring from storage to chutes and in filling. These cuts, as a rule, are of slight character but the effect of seeing persons working with bloody fingers wrapped in rags is repulsive. The handling of the empty cans should be done with gloves. Canvas gloves, made extra heavy on the wearing side, are inexpensive and will reduce cuts to almost a negligible quantity. The elimination of cuts on peeling and packing tables cannot be accomplished so easily. One of the late designs for continuous hand-filling machines embodies the idea of covering the edge of the can while it is being filled. The primary object of the design was for another purpose, but it is also successful in preventing this accident. Some products, like tomatoes, may be packed in trays holding either a half or a dozen cans, and a copper plate placed over the top. Though this is very simple and lacking in convenience, it is very effective.

"The ordinary can opener is a cause of many minor cuts, but fortunately a late invention overcomes this source of trouble. It is too large and expensive for domestic use, but very well adapted to factory needs.

"Many canners use some glass jars in putting up special lines, and a number manufacture ketchup, and thus require bottles. These packers invariably report more cuts than all other accidents combined. The machinery for handling glass is very imperfect. There is no good reason why the washing, rinsing, filling and capping of ketchup bottles should not be automatic and independent of any handling by human hands. In the meantime the use of gloves will afford some protection.

Floors

"Slippery floors are responsible for a fair share of accidents, varying from hard bruises to fractures of the wrist, arm and leg. The slippery floor is one of the conditions which should be abolished. At one time it was thought to be unavoidable owing to the water used in preparation, the overflow from syruping and filling machines, etc. A brining, syruping or filling machine which has no provision to receive and retain the overflow or the contents of a battered or overturned can, is no longer a necessity and does not fill one of the requirements of proper sanitation. There are decidedly better and cleaner methods of distributing the products to the tables and removing the filled cans than by the truck and tray system, so there is little need of water, juice and pieces of fruits and vegetables upon the floor. The best preventive of accidents from slipping is a dry floor, and this is attainable with care and proper equipment. Open gutters should not be permitted; instead flush irons or wood gratings should be provided. Wherever overflow is unavoidable, as in front of boiling kettles, blanchers, etc., slat gratings should be provided. It is not possible to avoid all water, overflow or bits of fruits and vegetables on the floor, but there can be a great reduction in the amount in most plants.

"Nearly all factory owners realize that the present floors lack a great deal of being ideal. Cement is the best from many standpoints, but is so hard and unyielding that it is extremely tiresome on the feet. A great deal of this foot and leg weariness may be overcome by the use of rubber heels for those who walk a great deal and the use of spring boards for those who are obliged to stand in one place.

Various Accidents

"A number of minor accidents were reported, due to women's hair being caught in the belts or moving machinery. This is easily prevented by wearing cotton caps—a practice that should appeal to one as being proper irrespective of the precaution against accidents.

"Getting dresses caught in moving machinery or conveyors is prevented in two ways —first, by proper guards, and, second, by a plain overdress which offers no loose ruffles or parts to be caught. In some of the larger factories, or in those running practically continuously, these dresses or uniforms, are made a necessity, and serve a useful purpose in preventing accidents, as well as in greater cleanliness. They are simple in construction, easily slipped on and off, and easily laundered.

"All factories employing a dozen or more women should have a rest room, provided with one or two chairs and a couch, where they may be taken in case of accidents, sudden illness, fainting, etc.

"The only point at which accidents were reported as affecting the eyes was in the operation of corn cutting. Several comments were made upon injuries occurring to the

eyes due to small particles of chaff and juice being thrown from the cutters. The simple preventive here is the wearing of plain goggles.

"The corn husking machine is one of the latest to be placed upon the market, but has not reached the point where it can be said to be properly guarded. The energy thus far has been spent upon the design to make it a success at husking. Without doubt this season will see many additions made to insure greater safety.

First Aid Outfit

"A first-aid package should be conveniently located in every factory. The equipment need not be large, but should be intended for use. It should consist of a small white enamel wash basin, pitcher, small hand brush, a pair of scissors, a one-half pound roll of absorbent cotton, a half dozen rolls of three-inch cheese-cloth bandages, one two-inch roll of adhesive tape, powdered boracic acid for dry dressing and as an antiseptic to be dissolved in water for cleansing. Boracic acid is a very efficient antiseptic and can be used at the rate of a teaspoonful to a quart of water, or as a dry powder, and with it there is none of the danger that may attend the misuse of mercurial tablets. A four-ounce bottle of aromatic spirits of ammonia is excellent as a stimulant in case of fainting or exhaustion, the dose being a teaspoonful in a half glass of water. It will answer the purpose better than brandy or whiskey. A three-ounce bottle of paregoric is advisable in cabinets in factories outside of town. This may be used in case of acute colic or cramps. It should be given only in the exceptional case and when a physician is not available. This should be marked 'Poison.' The dose is one-half to one teaspoonful, and can be repeated in a half hour. The use of paregoric is not to be encouraged and should be used only after the home remedies have failed or the pains remain very acute.

"For burns the best treatment is picric acid. A saturated solution should be made, and about one pint kept in stock. A small amount should be poured on the burn at frequent intervals. This is decidedly better than oil. Picric acid is poisonous and should be plainly marked 'Poison.'

"Some one should receive instructions from the local physician in properly cleaning an infected wound and in the proper application of the emergency bandages. It will be found that a very large per cent. of the accidents can be handled with this simple outfit."

STANDARD FIRE REQUIREMENTS FOR ALASKA CANNERIES

The following are the standard requirements for Alaska fish canning and packing plants adopted by the Board of Fire Underwriters of the Pacific:

Building: Wooden frame construction, composition or metal roof; side walls frame; area not exceeding 10,000 square feet; substantially built of sufficient size and strength to sustain weight of machinery and stock without serious strain or vibration; the construction throughout to be substantial and workmanlike.

Boiler and Stack: Boilers must be carefully bricked in and top covered with not less than four inches of brick; floor about boiler to be of non-combustible material. *Stacks* must extend not less than twenty feet above roof and have eighteen inches clearance from wood in roof or roof frame; and if wood is used for fuel must have an approved spark arrester.

Smokehouses: Brick or concrete walls, roof and floor; interior framing, racks, hangers and treads of iron with a grating not less than ten feet above fire. Communications to main building to be protected by standard fire floors. The sill in openings on firing floor to be at least one foot high. A drain to carry oil away from plant shall be provided. Vent of brick or metal to be provided if the smokehouse is not as high as the adjoining building. Steam jets to be provided.

Gasoline Power: Must be operated under what is known as a pumping system.

Fuel Oil: Oil-burning apparatus must be installed in accordance with rules of the National Board of Fire Underwriters, with pump feed to burners.

Electric Light and Power: The standard of the National Electrical Code shall govern in the installation of electrical machinery, wiring and devices.

Water Barrels and Chemical Extinguishers: One barrel to each 2500 square feet of floor area, or fraction thereof, with three buckets to each barrel, and not less than four barrels in any cannery.

Each building to have individual inside protection. One approved 3-gallon chemical extinguisher may be substituted for each barrel and three buckets.

Inside Standpipes: Standpipes not less than 2½ inches in diameter, having not to exceed 75 feet of good 1½-inch rubber-lined cotton hose, with appropriate nozzle attached, on each floor, supplied as per standard for private protection described below. Hydrants to be so located that all points of the building can be covered.

Outside Protection: Yard hydrants located fifty feet from, and within one hundred feet of, building, at least 2½ inches in diameter, supplied from city mains, or private supply up to standard described below, and 300 feet or more (number of hydrants and amount of hose depending upon extent of plant) of 2½-inch hose, with nozzles ¾ to 1-inch, to be used for fire purposes only.

Private Water Supply: Water supply from tank or reservoir, capacity not less than 50,000 gallons, located at least 100 feet from the main building and at an elevation sufficient to give 60 to 80 pounds pressure at the hydrants. Mains to be not less than 4-inch. Main from reservoir to be increased in size if the conditions demand it. If fire pump is relied upon to obtain efficient pressure (60 to 80 pounds), pump must have capacity of not less than 500 gallons per minute, inexhaustible water supply, steam maintained at all times, and the pump and boilers located in a brick building, protected by fire doors, if within 100 feet of main building.

City Water Supply: Supply to be either gravity or pumping system, giving pressure at hydrants of at least 60 pounds. Hydrants to be located on 6-inch or larger mains, to be of regular pattern, and not less than two within 200 feet of the main building. City having organized fire department, with at least 1000 feet of serviceable hose.

SWELLS AND SPRINGERS*

BY W. D. BIGELOW, CHIEF CHEMIST, NATIONAL CANNERS' ASSOCIATION, WASHINGTON, D. C.

The subject I have been asked to discuss this morning is one that would require a volume for its adequate consideration. It will be necessary, therefore, to confine ourselves to broad, fundamental principles. It would be much easier to occupy the time allotted by a detailed discussion of one of the phases of the subject. I realize, however, that the questions you have asked me indicate difficulties that frequently present themselves, and I shall cover as well as I can the outline suggested in your invitation to me to present this paper. This outline is as follows:

1. What constitutes a "swell" or "springer?"

2. What are the conditions of the product or of the process which might be a causative agent in producing swells or springers?

3. Where should the line be drawn as to what class of foods coming into this category might be safely and properly used as food products?

(a) Should canned fruits or vegetables belonging to the class of "swells" be permitted to be processed, or to be sold to be worked up into other products, such as the making of pie stock, or working up into butters, jams or marmalades?

(b) How may such class of fruits that have been worked up into various by-products be detected by commissioners?

(c) Does the presence of tin in excessive quantities denote that such products are made from swelled canned goods?

In considering this problem it is necessary to bear in mind the two general types of cans which are now used for the preservation of food. These are known respectively as the "hole and cap" can and the "open top" or "sanitary" can.

The hole and cap can is the one whose ends are soldered and which is closed after the introduction of the food by soldering in place a cap with a vent hole, which is then tipped with solder.

In the case of the open top can, one end is crimped on to the can by rollers, tightness being assured by means of a gasket of some elastic or compressible material, such as rubber composition.

*Read before the National Association of Food, Dairy and Drug Officials, Portland, Maine, July 15, 1914.

I shall now take up the subject according to the topics assigned in the program, but discussing the first and second topics together.

A swell in canned foods is a can which has undergone decomposition by micro-organisms, accompanied by the generation of gas, which first releases the vacuum and then causes pressure in the can. This decomposition is often of putrefactive nature and may be rapid or slow, according to the organism and temperature.

Swells are due either to defective sterilization or to leaky cans. It is sometimes difficult to measure the heat conductivity of a given product. Fruit which is thoroughly ripe has a tendency to cook up more than fruit that is greener, and thus lessen the heat conductivity of the liquid in the can. In the case of many products, such as corn, the heat required to penetrate to the center of the can increases with the consistency of the product. If the processor under-estimates the ripeness of a batch of fruit, therefore, or the consistency of a homogeneous product, or the amount of sugar added, swells may result.

Owing to defects in the manufacture of the can, or in the plate from which the can is made, there are occasional leaks, sometimes so small that when filled with air even at a pressure of 20 or 30 pounds the air that bubbles through them when placed under water is in such fine particles that it is difficult to see. When such cans are filled with food the bacteria that pass through these openings cause decomposition, and when pressure results the openings are sometimes closed by particles of food and are difficult to find.

A springer is a can whose ends are more or less bulged, owing to pressure from hydrogen generated as a result of the chemical action of the contents on the metal of the container, or because the can was over-filled or insufficiently exhausted.

In springers where the pressure is caused by over-filling the can, or by insufficient exhaust, this pressure does not increase with time, but remains constant, except as it is influenced by temperature of storage. The ends of the cans are somewhat distended and may be easily pressed into place with the fingers. When the fingers are removed the ends may resume a convex position, or may remain concave or flat (according to the pressure within the can) until the can is jarred, and sometimes until the temperature to which it is subjected is increased. A number of packers have put up products in the fall which appeared normal till the following summer, when springers developed, and when these were held till the cool weather of the following fall the ends resumed their normal concave position. Thus it has frequently happened that foods packed, for instance in New York, Maryland or Alaska, have been sold by packers who had no suspicion that they were abnormal in any way, and yet those that remained on the retailers' shelves the following summer, especially in the southern states, developed springers as a result of increased temperature.

Springers of this nature are found chiefly in open top cans, and only rarely in hole and cap cans. With the latter there is always sufficient head space, otherwise the soldering iron would heat the air space to so great an extent that it would be impossible to seal. It so happened that the use of the open top can was enormously increased at just the time when there was an effort on the part of the Federal Government, and also of the best canners, to secure a full can. It was immediately seen that it was possible to fill the open top can full. As a result a large amount of food was packed in the open top cans with very little head space, sometimes practically none. Now if such food was not heated to a pretty high temperature before it was capped, expansion naturally occurred after the product was shipped to a warmer climate and springers resulted. Many of the best firms found that a large proportion of their pack of some products consisted of springers immediately after canning; that is, the ends of the cans did not collapse on

cooling, but remained somewhat distended. As packers become more familiar with the open top cans and learn the amount of head space requisite and the necessity of a thorough exhaust, this difficulty is disappearing and springers of this nature will probably not be found to a large extent in the future.

The case is somewhat different when pressure is due to hydrogen generated by the action of acid fruits on the metal of the can. It is ordinarily taken for granted that the hydrogen thus generated is due to the action of the acid of the fruit on the tin. I think this is a mistake. I think it results in large part, at least, from the action of the acid on the iron and that the amount of hydrogen liberated in the can is usually a measure rather of the iron that has been dissolved than of the tin. The metallic taste in a product of this nature is certainly due to dissolved iron. Of course, where any great amount of iron is dissolved in the product, the tin is also dissolved, but passes largely into an insoluble form.

This question has been studied for several years and in several laboratories. Exhaustive investigations, devoted to the point and to the kindred questions of the action of the foods on the container, have been conducted (involving the expenditure of over $25,000), and the work is now being broadened and increased. Considerable progress has been made, but the solution is not yet in sight.

In this connection I wish to point out the relation of springers to certain other difficulties of the canner. The natural acids of the fruits attack the container, dissolving the iron and carrying tin into the food and into the liquor, where it is largely, often chiefly, precipitated in insoluble form. This liberates hydrogen, which directly causes springers. While in the nascent state this hydrogen bleaches many of the colored fruits. When lacquer is used in an attempt to prevent this action, pinholes often result, leading to the spoilage of a considerable percentage of the pack, and with some products an undesirable flavor is imparted by the lacquer. These difficulties all come from a common cause and will only be overcome by understanding and removing the cause. This statement, however, does not include the solvent action on the metals of the can of amino bodies in certain foods, such as shrimp, pumpkin and asparagus. (U. S. Dept. Agr. Bureau of Chem. Cir. 79.)

According to the amount and character of the fruit acid present, the tin and especially the iron of the container, are more or less attacked, the latter causing the astringency which is often called the "tin" taste of some canned food, and yielding springers of the class we are now discussing. Since the action is chemical, it is influenced by time and temperature of storage. It progresses more rapidly in summer than in winter; more rapidly in a hot warehouse than in one that is cold. The amount of hydrogen generated depends first on the temperature and time of sterilization; second on the promptness and efficiency of cooling after sterilization; third on the time of storage (the age of the canned product); fourth, on the temperature of storage. The relative importance of these four factors cannot be stated. In some cases the amount of tin and iron dissolved and the amount of hydrogen generated are greater within a week after canning than after two or three years, if cooled promptly and handled reasonably well.

The time that elapses before springers of the type now under consideration are formed depends on the four conditions mentioned above, and also on the fill of the cans, i. e., the amount of air space left, and on the vacuum in the can, or, in other words, the temperature of the product when the cans are sealed.

Since the amount of hydrogen increases with time and temperature of storage the pressure on the tin gradually increases until it cannot be distinguished by pressing with

the hand from swells. Finally the pressure becomes so great that a seam is sprung, causing leaks and leading to infection and decomposition.

In distinguishing between swells and springers it is important to bear in mind that the former usually progress rapidly and the latter slowly or not at all. Swells, therefore, usually become hard, or even burst before they reach the retail trade. In fact, it is the custom of canners to store their goods and permit such swells to develop as far as practicable before they leave the factory. After this it is usually only an occasional can that develops a leak and becomes infected. When a larger percentage of a lot of canned foods shows convex ends which may be pressed into place with the fingers, they are usually springers and not swells. Moreover, when decomposition has progressed so far that the ends begin to bulge, the odor on cutting the can is unmistakable, and even before that the peculiar aroma characteristic of the food is destroyed. *In this connection I wish to disclaim the idea that food whose appearance, odor and taste are acceptable to the consumer is necessarily free from decomposition or suitable for consumption, whether it be fresh or preserved.* There is a great difference, however, between decomposition in the open and in a confined space like a sealed tin can. In the open decomposition is more or less localized and its volatile products to which the characteristic odor of decomposition is due are largely dissipated, especially on cooking. In the can decomposition, when it occurs, is much more general throughout the mass and these volatile products are confined and are evident when the can is opened. A striking illustration of this is found in peas and corn held in the market till quite stale. They may be quite acceptable when prepared for the table in an open kettle, according to kitchen practice, and yet when canned have an offensive odor.

I feel that I am very safe in the statement that when decomposition has proceeded within the can to a sufficient extent to cause a perceptible bulging of the ends, the odor of decomposition is evident on cutting the can, even though it may have been vented and resterilized. Many consumers would doubtless overlook this distinction in some cases, just as they overlook staleness in market vegetables and incipient decomposition in fish and shell fish purchased as fresh. For the reasons given above, however, it is more evident than the same degree of decomposition in market fruits and vegetables. It should be evident to any careful observer and does not require the highly developed sense of taste and smell possessed by tasters of coffee and tea, and especially of wine. It must be borne in mind that as stated above springers due to over-filling or insufficient exhaust will be found in the market less frequently as packers learn the proper fill and exhaust. Springers due to hydrogen are found in strongly acid foods and are largely confined to the more acid fruits. The non-acid foods that attack tin or iron rarely form springers of this class. The three great staples in canned foods, tomatoes, peas and corn, neither attack the metals of the container to any appreciable extent, nor form springers due to hydrogen.

The third topic assigned to me is:

Where should the line be drawn as to what class of foods coming into this category might safely and properly be used as food products?

I will say without reservation that swells should not, under any circumstances, be used as food. Sometimes, especially in the case of fruit, such swells are the result not of bacterial decomposition, but of the action of yeasts and the products are simply sour. With the exception of highly nitrogenous material, it is probable that toxins are not formed in such swelled goods. In my opinion, however, it is to meet such conditions that a clause has been included in the Federal law, and all state laws, forbidding the sale of products which in whole or in part are "filthy, decomposed or putrid." Certainly that clause should be held to cover all food which it properly describes, whatever its form and

manner of preservation, and all canned foods which are "swells" as a result of decomposition by micro-organisms are intended to be covered by this clause and should be covered by it. They should not be used as food or in the preparation of food.

With springers the case is widely different. Springers due to over-filling or insufficient exhaust are sound and edible in all respects. As I have already stated, however, this type of springers will soon be a matter of history. With springers of the second type, after the action of the acid on the metal has proceeded to such an extent that the product cannot be distinguished from a true swell, it is my opinion that they should be condemned and destroyed. The strong metallic taste due to dissolved iron is commonly so pronounced in such cases as to make the product unpalatable. Moreover, as I have said before, it can not by outward appearance be distinguished from a swell.

As just stated in the case of springers due alone to over-filling the can or insufficient exhaust the contents are sterile and sound in every way and their use as food, or for the manufacture of foods, should be permitted. It is obvious that their sale on the market in that form is impossible and in my opinion it should not be possible. The bulged end, even if it can be readily pushed in place with the fingers, is taken by the consumer as a warning sign, indicating decomposition. It is a safe and reasonable sign and one which the consumer should continue to use. If food products of this nature are to be sold, therefore, the cans must be heated, vented, resealed and again sterilized.

I realize that the work of food commissioners would be simplified if the venting of an open top can, for instance, were held to be *prima facie* evidence of decomposition. Such a practice, however, is not logical nor necessary in order to protect the consumer. It should not be possible acting under the name of the law, to prevent or restrict the sale of food that is sound and wholesome, prepared under good conditions, and in every respect suitable for consumption. Such a decision is unjust to the manufacturer and prejudicial to the public good in so far that it is uneconomic.

It is a recognized principle of legislation that the public health must be protected even though hardship to many be worked thereby. This principle, however, does not apply to the question under discussion. Danger to the public health is not involved. As far as I can learn, there is no evidence and no reason to suppose that illness is ever caused by a product of this nature.

When a can of food has undergone decomposition by micro-organisms to such an extent as to cause the slightest bulging of the ends, it is practically impossible for it to be reprocessed in such a manner that the decomposition will not be betrayed to a careful observer by the odor. By reprocessing in this connection, I refer merely to venting and resterilization in the can, and not to cooking in an open kettle with or without added sugar and flavor in the preparation of other products.

Again, it may be found advisable to vent all cans used for certain products, such as meat, fish and shell fish. It has always been customary in packing salmon in hole and cap cans to close the vent in the middle of the cap immediately after sealing, heat in the process retort, revent to allow the air to escape, close the second vent and sterilize. Since the advent of the open top can without vent holes, I am told by my associate, Dr. Bitting, that the product may be somewhat inferior. It appears that by the second venting in the cap of the old can, there are expelled not only air, but also gases caused by heating the fish and whose retention in the absence of vent holes gives the product a stale odor and flavor. By interrupting the process and venting the open top cans this can be avoided, as in the hole and cap cans. Recent experiments conducted by Dr. Bitting with crabs gave the same results. It is believed that this difficulty has been practically overcome by using two sealing machines. With the first one the cover is loosely crimped on the can,

which is then given a thorough exhaust and sealed while hot in the second machine. At the same time it is possible that with some products the higher degree of excellence cannot be secured even with the open top can without venting after a preliminary heating in the process retort.

I regret that the subject assigned to me includes one question which I cannot answer:

How may such class of fruits that have been worked up into various by-products be detected by commissioners?

If this practice were extensive, I would suggest that it might be handled by factory inspection, but conducted as I am informed it is, in a small way, irregularly and only by men who have no connection with any legitimate industry, the inspection of the factories where such by-products are made appears to be out of the question.

Of course, it is obvious that swells in an advanced state of decomposition cannot be used in the preparation of any food whatever. There is no doubt that the great majority of so-called swells which are used in the preparation of products of this nature are not really swells in the sense of having been caused by decomposition, but owe their distension to hydrogen gas formed by the action of the fruit acids on the metal of the container.

At the same time the situation is different from that found in reprocessing foods in the can. In the case of certain fruit products which have begun to swell, even as a result of decomposition, it is probably sometimes possible, by boiling the product in an open kettle, to eliminate the odor of decomposition to such an extent that it is masked to the ordinary taste and smell by the addition of sugar and flavors. This practice is most reprehensible and all possible effort should be made to stop it. Its detection, however, in the finished product is attended by considerable difficulty. Probably the best method is by means of the microscope. Even if the decomposition has not proceeded to an advanced degree, when it has occurred in enclosed space such as a sealed tin can, it is found to be quite general and the histology of the product is changed. Unfortunately, this method can only be employed by analysis with long training and experience in structural botany, and there are very few analysts in the country who are competent to undertake the study of the question. It is hoped that in the near future more attention will be given to this line of work. Chemical methods have not been thoroughly worked out and I do not know that they are possible, though undoubtedly progress can be made in this field.

The determination of the character and amount of acid in fruit products is often of value. In this manner a clue to decomposition can sometimes be obtained by the fact that the normal acid of the fruit in question is not present in proper amount. Lactic acid, which usually accompanies decomposition in tomatoes, is not ordinarily found in decomposition of fruits. It would be strange, however, if the application of bio-chemistry to the problem did not disclose some by-product of the life of micro-organisms that might be considered sufficient evidence of decomposition. The attention that has been paid to the detection of decomposition in food is not at all commensurate with our needs. The situation calls for work of a different type from any that has been largely utilized in detecting food adulteration. Such methods are needed, however, not for the examination of products of the type mentioned, but, broadly speaking, for the detection of decomposition in food, whether fresh or preserved and whatever the manner of its preservation.

Perhaps the most striking feature of the packing of goods in recent years is the progress that has been made in the cleanliness and sanitation of factories and in washing the raw products and hand sorting and trimming to exclude from the finished product rot and decay which, when we come to think of it, is decomposed matter and just as objectionable as that found in a swelled can. Notwithstanding this progress, however, the

amount of such decomposed matter that reaches our tables in our foods, both fresh and manufactured, is still so great that the amount of decomposition introduced into pie filling, jams and fruit butters in the form of blown cans, dwindles into insignificance. I do not depreciate the gravity of the latter practice, but wish to emphasize the fact that to give it serious consideration before a more determined effort is made to insure a more satisfactory sanitary condition in food factories of all kinds is like "straining at a gnat and swallowing a camel."

The final question asked me is:

Does the presence of tin in excessive quantities denote that such products are made from swelled canned goods?

Most emphatically it does not. Of course the decomposition that causes the swelling of canned fruits increases their acid content and hence their action on the tin and iron. At the same time, some products which are badly decomposed, even though the pressure has become so great that the can has burst, are not as acid and do not attack the metals of the container as badly as other products which are entirely fresh and sterile. Probably an excessive amount of tin or iron in pie stock, butters, jams and similar materials may indicate that the product has been made from canned material which has attacked the metal of the container to such an extent that it could not be sold as canned food, whether decomposed or not. In the absence of evidence of decomposition probably it may be held that in working over such products in this manner their inferiority is concealed and for that reason their sale is illegal.

The charge of selling food containing "filthy, decomposed or putrid" material is a very serious one and its full meaning should be preserved. This can only be done by limiting the application of that term to products whose decomposition can be demonstrated.

The presence of tin is obviously not an indication of decomposition and to hold it *prima facie* evidence of decomposition is unnecessary as a precaution and would weaken the law and lessen the sense of fairness and justice so necessary to its proper enforcement.

FEDERAL FOOD INSPECTION

All canned foods, except those consumed within the state in which they are manufactured, come within the purview of the Federal Food and Drugs Act, passed June 30, 1906. All food products intended for export must be packed in conformity with the Federal requirements for purity, except that "food products intended for export may contain substances not permitted in foods intended for interstate commerce when the addition of such substances does not conflict with the laws of the countries to which the food products are to be exported and when such substances are added in accordance with the directions of the foreign purchasing agent." This act, which is administered by the Bureau of Chemistry of the Department of Agriculture, and applying to all foods entering interstate and foreign commerce, has had a most wholesome effect in raising the quality of canned foods.

The provisions of the Food and Drugs Act are particularly strong with reference to adulteration, misbranding and the use of unfit material. The terms misbranding and adulteration are made to have a more comprehensive meaning than is the general conception by specification in a definition, as will be noted by referring to the act printed below.

These provisions are simple and direct and apply to the purity of the product but not to the grade. No standards for the latter have been established. These provisions have been amplified by numerous "Food and drug decisions," all together making quite a volume in itself, which, while not having the effect of law, indicate the interpretation that the officials charged with the enforcement desire to have placed upon the decisions, and are accepted as guides by the manufacturers. While there are no legal standards for canned foods, there are trade standards accepted by the manufacturer and dealer, which are indicated under the various articles.

An important feature of the law is that requiring a statement of the quantity of contents upon the label. This statement should be plainly and conspicuously printed and must be a correct statement. Where the quantity in a package will vary it is advisable to state the minimum weight the package will contain. Do not use the word "minimum" or any similar language; make a definite, unqualified statement. The variation must not be below the amount stated oftener than it is above the amount stated. If you attempt to state the average weight or measure you must be sure it will be the average on every case of goods you put out. It is not sufficient to have one case of goods average above the stated weight, and another case average below the weight or measure. Every case of goods should average correctly. The terms "net weight" or "net measure" mean exclusive of all wrappers, containers, etc. They mean that the actual weight or measure of the commodity in the package must be stated. The terms "weight of contents" or "measure of contents" is a better one to use, and this applies to all goods except those destined for states requiring the use of the term "net" in connection with the statement of the quantity of contents. Weights should be stated in terms of pounds, ounces and grams avoirdupois. Measures should be stated in terms of gallons, quarts and fluid ounces. The statement of contents should be printed in type proportionate in size to the other type on the label. It is not sufficient to make this statement in type equal in size to the smallest type employed for the expression of other matters on the label.

The provisions of the Federal Food and Drugs Act apply particularly to the finished product, but are sufficiently broad to cover the inspection of the manufacturing plants, so as to determine the character of the raw material used and the sanitation. The various states have their own pure food and sanitary laws, which, while not uniform, agree in essential points with the Federal law, and thereby supplement the latter in the control of the conditions and methods of manufacture.

Owing to lack of space it has been impossible to reproduce the state laws, while only a few of the more important Federal decisions can be given. These questions are so important that each canner should make an effort to familiarize himself with them or should join some canners' or fishery organization—such as the National Canners' Association or the Association of Pacific Fisheries—in which event he would be enabled to call upon such for help and information along any line needed.

The Food and Drugs Act, June 30, 1906, as Amended August 23, 1912

AN ACT for preventing the manufacture, sale, or transportation of adulterated or misbranded or poisonous or deleterious foods, drugs, medicines and liquors, and for regulating traffic therein, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That it shall be unlawful for any person to manufacture within any territory or the District of Columbia any article of food or drug which is adulterated or misbranded, within the meaning of this act; and any person who shall violate any of the provisions of this section shall be guilty of a misdemeanor, and for each offence shall, upon conviction thereof, be fined not to exceed five hundred dollars or shall be sentenced to one year's imprisonment, or both such fine and imprisonment, in the discretion of the court, and for each subsequent offence and conviction thereof

shall be fined not less than one thousand dollars or sentenced to one year's imprisonment, or both such fine and imprisonment, in the discretion of the court.

SEC. 2. That the introduction into any state or territory or the District of Columbia from any other state or territory or the District of Columbia, or from any foreign country, or shipment to any foreign country of any article of food or drugs which is adulterated or misbranded, within the meaning of this act, is hereby prohibited; and any person who shall ship or deliver for shipment from any state or territory or the District of Columbia, to any other state or territory or the District of Columbia, or to a foreign country, or who shall receive in any state or territory or the District of Columbia from any other state or territory or the District of Columbia, or foreign country, and having so received, shall deliver, in original unbroken packages, for pay or otherwise, or offer to deliver to any other person, any such article so adulterated or misbranded within the meaning of this act, or any person who shall sell or offer for sale in the District of Columbia or the territories of the United States any such adulterated or misbranded foods or drugs, or export or offer to export the same to any foreign country, shall be guilty of a misdemeanor, and for such offence be fined not exceeding two hundred dollars for the first offence, and upon conviction for each subsequent offence not exceeding three hundred dollars or be imprisoned not exceeding one year, or both, in the discretion of the court: *Provided*, That no article shall be deemed misbranded or adulterated within the provisions of this act when intended for export to any foreign country and prepared or packed according to the specifications or directions of the foreign purchaser when no substance is used in the preparation or packing thereof in conflict with the laws of the foreign country to which said article is intended to be shipped; but if said article shall be in fact sold or offered for sale for domestic use or consumption, then this proviso shall not exempt said article from the operation of any of the other provisions of this act.

SEC. 3. That the Secretary of the Treasury, the Secretary of Agriculture, and the Secretary of Commerce and Labor shall make uniform rules and regulations for carrying out the provisions of this act, including the collection and examination of specimens of foods and drugs manufactured or offered for sale in the District of Columbia, or in any territory of the United States, or which shall be offered for sale in unbroken packages in any state other than that in which they shall have been respectively manufactured or produced, or which shall be received from any foreign country, or intended for shipment to any foreign country, or which may be submitted for examination by the chief health, food, or drug officer of any state, territory, or the District of Columbia, or at any domestic or foreign port through which such product is offered for interstate commerce, or for export or import between the United States and any foreign port or country.

Sec. 4. That the examinations of specimens of foods and drugs shall be made in the Bureau of Chemistry of the Department of Agriculture, or under the direction and supervision of such Bureau, for the purpose of determining from such examinations whether such articles are adulterated or misbranded within the meaning of this act; and if it shall appear from any such examination that any of such specimens is adulterated or misbranded within the meaning of this act, the Secretary of Agriculture shall cause notice thereof to be given to the party from whom such sample was obtained. Any party so notified shall be given an opportunity to be heard, under such rules and regulations as may be prescribed as aforesaid, and if it appears that any of the provisions of this act have been violated by such party, then the Secretary of Agriculture shall at once certify the facts to the proper United States district attorney, with a copy of the results of the analysis or the examination of such article duly authenticated by the analyst or officer making such examination, under the oath of such officer. After the judgment of the court, notice shall be given by publication in such manner as may be prescribed by the rules and regulations aforesaid.

Sec. 5. That it shall be the duty of each district attorney to whom the Secretary of Agriculture shall report any violation of this act, or to whom any health or food or drug officer or agent of any state, territory, or the District of Columbia shall present satisfactory evidence of any such violation, to cause appropriate proceedings to be commenced and prosecuted in the proper courts of the United States, without delay, for the enforcement of the penalties as in such case herein provided.

Sec. 6. That the term "drug" as used in this act, shall include all medicines and preparations recognized in the United States Pharmacopœia or National Formulary for internal or external use, and any substance or mixture of substances intended to be used for the cure, mitigation, or prevention of disease of either man or other animals. The term "food," as used herein, shall include all articles used for food, drink, confectionery or condiment by man or other animals, whether simple, mixed, or compound.

Sec. 7. That for the purposes of this act an article shall be deemed to be adulterated:

In the case of drugs:

First. If, when a drug is sold under or by a name recognized in the United States Pharmacopœia or National Formulary, it differs from the standard of strength, quality, or purity, as determined by the test laid down in the United States Pharmacopœia or National Formulary official at the time of investigation: *Provided*, That no drug defined in the United States Pharmacopœia or National Formulary shall be deemed to be adulterated under this provision if the standard of strength, quality, or purity be plainly stated upon the bottle, box, or other container thereof although the standard may differ from that determined by the test laid down in the United States Pharmacopœia or National Formulary.

Second. If its strength or purity fall below the professed standard or quality under which it is sold.

In the case of confectionery:

If it contain terra alba, barytes, talc, chrome yellow, or other mineral substance or poisonous color or flavor, or other ingredient deleterious or detrimental to health, or any vinous, malt, or spirituous liquor or compound or narcotic drug.

In the case of food:

First. If any substance has been mixed and packed with it so as to reduce or lower or injuriously affect its quality or strength.

Second. If any substance has been substituted wholly or in part for the article.

Third. If any valuable constituent of the article has been wholly or in part abstracted.

Fourth. If it be mixed, colored, powdered, coated or stained in a manner whereby damage or inferiority is concealed.

Fifth. If it contain any added poisonous or other added deleterious ingredient which may render such article injurious to health: *Provided*, That when in the preparation of food products for shipment they are preserved by any external application applied in such manner that the preservative is necessarily removed mechanically, or by maceration in water, or otherwise, and directions for the removal of said preservative shall be printed on the covering or the package, the provisions of this act shall be construed as applying only when said products are ready for consumption.

Sixth. If it consists in whole or in part of a filthy, decomposed, or putrid animal or vegetable substance, or any portion of an animal unfit for food, whether manufactured or not, or if it is the product of a diseased animal, or one that has died otherwise than by slaughter.

Sec. 8. That the term "misbranded," as used herein, shall apply to all drugs or articles of food, or articles which enter into the composition of food, the package or label of which shall bear any statement, design, or device regarding such article, or the ingredients or substances contained therein which shall be false or misleading in any particular, and to any food or drug product which is falsely branded as to the state, territory, or country in which it is manufactured or produced.

That for the purposes of this act an article shall also be deemed to be misbranded:

In the case of drugs:

First. If it be an imitation of or offered for sale under the name of another article.

Second. If the contents of the package as originally put up shall have been removed, in whole or in part, and other contents shall have been placed in such package, or if the package fail to bear a statement on the label of the quantity or proportion of any alcohol, morphine, opium, cocaine, heroin, alpha or beta eucaine, chloroform, cannabis indica, chloral hydrate, or acetanilide, or any derivative or preparation of any such substances contained therein.

Third. If its package or label shall bear or contain any statement, design, or device regarding the curative or therapeutic effect of such article or any of the ingredients or substances contained therein, which is false and fraudulent.

In the case of food:

First. If it be an imitation of or offered for sale under the distinctive name of another article.

Second. If it be labeled or branded so as to deceive or mislead the purchaser, or purport to be a foreign product when not so, or if the contents of the package as originally put up shall have been removed in whole or in part and other contents shall have been placed in such package, or if it fail to bear a statement on the label of the quantity or proportion of any morphine, opium, cocaine, heroin, alpha or beta eucaine, chloroform, cannabis indica, chloral hydrate, or acetanilide, or any derivative or preparation of any of such substances contained therein.

Third.* If in package form, the quantity of the contents be not plainly and conspicuously marked on the outside of the package in terms of weight, measure, or numerical count: *Provided, however*, That reasonable variations shall be permitted, and tolerances and also exemptions as to small packages shall be established by rules and regulations made in accordance with the provisions of section three of this act.

Fourth. If the package containing it or its label shall bear any statement, design, or device regarding the ingredients or the substances contained therein, which statement, design, or device shall be false or misleading in any particular: *Provided*, That an article of food which does not contain any added poisonous or deleterious ingredients shall not be deemed to be adulterated or misbranded in the following cases:

First. In the case of mixtures or compounds which may be now or from time to time hereafter known as articles of food, under their own distinctive names, and not an imitation of or offered for sale under the distinctive name of another article, if the name be accompanied on the same label or brand with a statement of the place where said article has been manufactured or produced.

Second. In the case of articles labeled, branded, or tagged so as to plainly indicate that they are compounds, imitations, or blends, and the word "compound," "imitation," or "blend," as the case may be, is plainly stated on the package in which it is offered for sale: *Provided*, That the term blend as used herein shall be construed to mean a mixture of like substances, not excluding harmless coloring or flavoring ingredients used for the purpose of coloring and flavoring only: *And provided further*, That nothing in this act shall be construed as requiring or compelling proprietors or manufacturers of proprietary foods which contain no unwholesome added ingredient to disclose

*The act of March 3, 1913, provides that no penalty of fine, imprisonment, or confiscation shall be enforced for any violation of its provisions as to domestic products prepared or foreign products imported prior to eighteen months after its passage.

their trade formulas, except in so far as the provisions of this act may require to secure freedom from adulteration or misbranding.

Sec. 9. That no dealer shall be prosecuted under the provisions of this act when he can establish a guaranty signed by the wholesaler, jobber, manufacturer, or other party residing in the United States, from whom he purchases such articles, to the effect that the same is not adulterated or misbranded within the meaning of this act, designating it. Said guaranty, to afford protection, shall contain the name and address of the party or parties making the sale of such articles to such dealer, and in such case said party or parties shall be amenable to the prosecutions, fines and other penalties which would attach, in due course, to the dealer under the provisions of this act.

Sec. 10. That any article of food, drug, or liquor that is adulterated or misbranded within the meaning of this act, and is being transported from one state, territory, district, or insular possession to another for sale, or, having been transported, remains unloaded, unsold or in original unbroken packages, or if it be sold or offered for sale in the District of Columbia or the territories, or insular possessions of the United States, or if it be imported from a foreign country for sale, or if it is intended for export to a foreign country, shall be liable to be proceeded against in any district court of the United States within the district where the same is found, and seized for confiscation by a process of libel for condemnation. And if such article is condemned as being adulterated or misbranded, or of a poisonous or deleterious character, within the meaning of this act, the same shall be disposed of by destruction or sale, as the said court may direct, and the proceeds thereof, if sold, less the legal costs and charges, shall be paid into the Treasury of the United States, but such goods shall not be sold in any jurisdiction contrary to the provisions of this act or the laws of that jurisdiction: *Provided, however,* That upon the payment of the costs of such libel proceedings and the execution and delivery of a good and sufficient bond to the effect that such articles shall not be sold or otherwise disposed of contrary to the provisions of this act, or the laws of any state, territory, district or insular possession, the court may by order direct that such articles be delivered to the owner thereof. The proceedings of such libel cases shall conform, as near as may be, to the proceedings in admiralty, except that either party may demand trial by jury of any issue of fact joined in any such case, and all proceedings shall be at the suit of and in the name of the United States.

Sec. 11. The Secretary of the Treasury shall deliver to the Secretary of Agriculture, upon his request from time to time, samples of foods and drugs which are being imported into the United States or offered for import, giving notice thereof to the owner or consignee, who may appear before the Secretary of Agriculture, and have the right to introduce testimony, and if it appear from the examination of such samples that any article of food or drug offered to be imported into the United States is adulterated or misbranded within the meaning of this act, or is otherwise dangerous to the health of the people of the United States, or is of a kind forbidden entry into, or forbidden to be sold or restricted in sale in the country in which it is made or from which it is exported, or is otherwise falsely labeled in any respect, the said article shall be refused admission, and the Secretary of the Treasury shall refuse delivery to the consignee and shall cause the destruction of any goods refused delivery which shall not be exported by the consignee within three months from the date of notice of such refusal under such regulations as the Secretary of the Treasury may prescribe: *Provided,* That the Secretary of the Treasury may deliver to the consignee such goods pending examination and decision in the matter on execution of a penal bond for the amount of the full invoice value of such goods, together with the duty thereon, and on refusal to return such goods for any cause to the custody of the Secretary of the Treasury, when demanded, for the purpose of excluding them from the country, or for any other purpose, said consignee shall forfeit the full amount of the bond: *And provided further,* That all charges for storage, cartage, and labor on goods which are refused admission or delivery shall be paid by the owner or consignee, and in default of such payment shall constitute a lien against any future importation made by such owner or consignee.

Sec. 12. That the term "territory" as used in this act shall include the insular possessions of the United States. The word "person" as used in this act shall be construed to import both the plural and the singular, as the case demands, and shall include corporations, companies, societies and associations. When construing and enforcing the provisions of this act, the act, omission, or failure of any officer, agent, or other person acting for or employed by any corporation, company, society, or association, within the scope of his employment or office, shall in every case be also deemed to be the act, omission, or failure of such corporation, company, society, or association as well as that of the person.

Sec. 13. That this act shall be in force and effect from and after the first day of January, nineteen hundred and seven.

Approved June 30, 1906.

TRADE MARKS AND THE PROTECTION OF SAME

More than one manufacturer has found in practice that his trade marks are just as valuable, or more valuable, than his patents. A patent is likely to be infringed or imitated and expires in seventeen years; a trade mark, wisely used, has perpetual life. A trade mark is a necessary incident of all modern merchandising, whether it be canned goods

or steel, glassware or clothing, so that the absence of a well-defined trade mark in any manufacturing business is an anomaly.

In commerce any name by which an article is known may be loosely classed as a trade mark. In law, however, a sharp distinction is drawn between names or marks which are capable of exclusive appropriation as the property of the first user and names or marks which are geographical or descriptive in character, and therefore cannot be the monopoly of any person.

For many years but few fish canners appreciated the value of a trade mark to place on their can labels, and it has taken some bitter experiences to drive home to the rest that a properly designed trade mark placed upon good goods and the owner protected in its use by the law, has real value, just as much as boats, buildings, machinery, or the thousand and one material things required to carry on the business.

Ownership of trade marks in the United States is still dependent upon the common law, so that the first user of a trade mark who can establish his priority is entitled to the ownership of the same, whether the mark is registered or unregistered. Claimants under the common law will, however, find proceedings to prevent infringement expensive, annoying to a busy man, and at best will protect one only after at least a certain amount of damage has been done, and it is far safer to avoid this by registering the label at the time of issue, which will give one the further advantage in that a description of the character and quality of the article labeled can be set forth, which will, to a certain extent at least, be protected with the label.

Registration of a trade mark entitles the registrant to bring a suit in a Federal court for the protection of his mark instead of a local state court, and this is frequently an important advantage.

The trade mark statute provides that the registrant shall be the *prima facie* owner of the mark, for the recovery of damages, the right to an injunction, the delivery up of infringing labels, and, what is frequently important, the prevention of the entry of goods into this country bearing an infringing trade mark. Where the mark is registered in the United States Patent Office, the Treasury Department will without further expense watch all importations to prevent the coming into this country of goods bearing an infringing mark.

Furthermore, unless the United States trade mark owner registers his trade mark in this country, he can in very many instances not register his trade mark in foreign countries where registration is absolutely necessary to ownership.

It should furthermore be noted that when a mark is once registered in the United States Patent Office, the Patent Office will automatically refuse to register the same or a similar mark to another party, whereas if your mark is not registered, any person making the proper form of application is legally entitled to register the same. The statute provides for opposing or cancelling the registration of an interfering trade mark, but such proceedings are always expensive in comparison to the low cost of registration.

A trade mark is registered for only a particular line of goods; that is, a registration of a trade mark for salmon confers no right on the same registrant to said mark for shoes or candies. The Patent Office has divided registrations into forty-nine classes, of which class 46, "Foods and ingredients of foods," includes all food products.

The following comprise the trade mark laws of the United States as enacted in 1905, with subsequent amendments:

Trade Mark Laws of the United States

Act of February 20, 1905 (as amended)

AN ACT to authorize the registration of trade marks used in commerce with foreign nations or among the several states or with Indian tribes, and to protect the same.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the owner of a trade mark used in commerce with foreign nations, or among the several states, or with Indian tribes, provided such owner shall be domiciled within the territory of the United States, or resides in or is located in any foreign country which, by treaty, convention, or law, affords similar privileges to the citizens of the United States, may obtain registration for such trade mark by complying with the following requirements; First, by filing in the Patent Office an application therefor, in writing, addressed to the Commissioner of Patents, signed by the applicant, specifying his name, domicile, location, and citizenship; the class of merchandise and the particular description of goods comprised in such class to which the trade mark is appropriated; a statement of the mode in which the same is applied and affixed to goods, and the length of time during which the trade mark has been used; a description of the trade mark itself shall be included, if desired by the applicant or required by the commissioner, provided such description is of a character to meet the approval of the commissioner. With this statement shall be filed a drawing of the trade mark, signed by the applicant, or his attorney, and such number of specimens of the trade mark as actually used as may be required by the Commissioner of Patents. Secondly, by paying into the Treasury of the United States the sum of ten dollars, and otherwise complying with the requirements of this act and such regulations as may be prescribed by the Commissioner of Patents.

Sec. 2. That the application prescribed in the foregoing section, in order to create any right whatever in favor of the party filing it, must be accompanied by a written declaration verified by the applicant, or by a member of the firm or an officer of the corporation or association applying, to the effect that the applicant believes himself or the firm, corporation, or association in whose behalf he makes the application to be the owner of the trade mark sought to be registered, and that no other person, firm, corporation, or association, to the best of the applicants' knowledge and belief, has the right to use such trade mark in the United States, either in the identical form or in such near resemblance thereto as might be calculated to deceive; that such trade mark is used in commerce among the several states, or with foreign nations, or with Indian tribes, and that the description and drawing presented truly represents the trade mark sought to be registered. If the applicant resides or is located in a foreign country, the statement required shall, in addition to the foregoing, set forth that the trade mark has been registered by the applicant, or that an application for the registration thereof has been filed by him in the foreign country in which he resides or is located, and shall give the date of such registration, or the application therefor, as the case may be, except that in the application in such cases it shall not be necessary to state that the mark has been used in commerce with the United States or among the states thereof. The verification required by this section may be made before any person within the United States authorized by law to administer oaths, or, when the applicant resides in a foreign country, before any minister, charge d'affaires, consul, or commercial agent holding commission under the Government of the United States, or before any notary public, judge, or magistrate having an official seal and authorized to administer oaths in the foreign country in which the applicant may be whose authority shall be proved by a certificate of a diplomatic or consular officer of the United States.

Sec. 3. That every applicant for registration of a trade mark, or for renewal of registration of a trade mark, who is not domiciled within the United States, shall, before the issuance of the certificate of registration, as hereinafter provided for, designate, by a notice in writing, filed in the Patent Office, some person residing within the United States on whom process or notice of proceedings affecting the right of ownership of the trade mark of which such applicant may claim to be the owner, brought under the provisions of this act or under other laws of the United States, may be served, with the same force and effect as if served upon the applicant or registrant in person. For the purposes of this act it shall be deemed sufficient to serve such notice upon such applicant, registrant, or representative by leaving a copy of such process or notice addressed to him at the last address of which the Commissioner of Patents has been notified.

Sec. 4. That an application for registration of a trade mark filed in this country by any person who has previously regularly filed in any foreign country which, by treaty, convention, or law, affords similar privileges to citizens of the United States an application for registration of the same trade mark shall be accorded the same force and effect as would be accorded to the same application if filed in this country on the date on which application for registration of the same trade mark was first filed in such foreign country: *Provided*, That such application is filed in this country within four months from the date on which the application was first filed in such foreign country: *And provided*, That certificate of registration shall not be issued for any mark for registration of which application has been filed by an applicant located in a foreign country until such mark has been actually registered by the applicant in the country in which he is located.

Sec. 5. That no mark by which the goods of the owner of the mark may be distinguished from the other goods of the same class shall be refused registration as a trade mark on account of the nature of such mark unless such mark—

(a) Consists of or comprises immoral or scandalous matter.

(b) Consists of or comprises the flag or coat of arms or other insignia of the United States or any simulation thereof, or of any state or municipality or of any foreign nation, or of any design

or picture that has been or may hereafter be adopted by any fraternal society as its emblem, *or of any name, distinguishing mark, character, emblem, colors, flag, or banner adopted by any institution, organization, club or society which was incorporated in any state in the United States prior to the date of the adoption and use by the applicant: Provided, That said name, distinguishing mark, character, emblem, colors, flag, or banner was adopted and publicly used by said institution, organization, club, or society prior to the date of adoption and use by the applicant: Provided,* That trade marks which are identical with a registered or known trade mark owned and in use by another and appropriated to merchandise of the same descriptive properties, or which so nearly resemble a registered or known trade mark owned and in use by another and appropriated to merchandise of the same descriptive properties as to be likely to cause confusion or mistake in the mind of the public or to deceive purchasers shall not be registered: *Provided*, That no mark which consists merely in the name of an individual, firm, corporation, or association not written, printed, impressed, or woven in some particular or distinctive manner, or in association with a portrait of the individual, or merely in words or devices which are descriptive of the goods with which they are used, or of the character or quality of such goods, or merely a geographical name or term, shall be registered under the terms of this act: *Provided further*, That no portrait of a living individual may be registered as a trade mark except by the consent of such individual, evidenced by an instrument in writing: *And provided further*, That nothing herein shall prevent the registration of any mark used by the applicant or his predecessors, or by those from whom title to the mark is derived, in commerce with foreign nations or among the several states or with Indian tribes which was in actual and exclusive use as a trade mark of the applicant, or his predecessors from whom he derived title, for ten years next preceding February twentieth, nineteen hundred and five: *Provided further*, That nothing herein shall prevent the registration of a trade mark otherwise registrable because of its being the name of the applicant or a portion thereof.

Sec. 6. That on the filing of an application for registration of a trade mark which complies with the requirements of this act, and the payment of the fees herein provided for, the Commissioner of Patents shall cause an examination thereof to be made; and if on such examination it shall appear that the applicant is entitled to have his trade mark registered under the provisions of this act, the commissioner shall cause the mark to be published at least once in the Official Gazette of the Patent Office. Any person who believes he would be damaged by the registration of a mark may oppose the same by filing notice of opposition, stating the grounds therefor, in the Patent Office within thirty days after the publication of the mark sought to be registered, which said notice of opposition shall be verified by the person filing the same before one of the officers mentioned in section two of this act. An opposition may be filed by a duly authorized attorney, but such opposition shall be null and void unless verified by the opposer within a reasonable time after such filing. If no notice of opposition is filed within said time, the commissioner shall issue a certificate of registration therefor, as hereinafter provided for. If on examination an application is refused, the commissioner shall notify the applicant, giving him his reasons therefor.

Sec. 7. That in all cases where notice of opposition has been filed the Commissioner of Patents shall notify the applicant thereof and the grounds therefor.

Whenever an application is made for the registration of a trade mark which is substantially identical with a trade mark appropriated to goods of the same descriptive properties, for which a certificate of registration has been previously issued to another, or for registration of which another has previously made application, or which so nearly resembles such trade mark, or a known trade mark owned and used by another, as, in the opinion of the commissioner, to be likely to be mistaken therefor by the public, he may declare that an interference exists as to such trade mark, and in every case of interference or opposition to registration he shall direct the examiner in charge of interferences to determine the question of the right of registration to such trade mark, and of the sufficiency of objections to registration, in such manner and upon such notice to those interested as the commissioner may by rules prescribe.

The commissioner may refuse to register the mark against the registration of which objection is filed, or may refuse to register both of two interfering marks, or may register the mark, as a trade mark, for the person first to adopt and use the mark, if otherwise entitled to register the same, unless an appeal is taken, as hereinafter provided for, from his decision, by a party interested in the proceeding, within such time (not less than twenty days) as the commissioner may prescribe.

Sec. 8. That every applicant for the registration of a trade mark, or for the renewal of the registration of a trade mark, which application is refused, or a party to an interference against whom a decision has been rendered, or a party who has filed a notice of opposition as to a trade mark may appeal from the decision of the examiner in charge of trade marks, or the examiner in charge of interferences, as the case may be, to the commissioner in person, having once paid the fee for such appeal.

Sec. 9. That if an applicant for registration of a trade mark, or a party to an interference as to a trade mark, or a party who has filed an opposition to the registration of a trade mark, or party to an application for the cancellation of the registration of a trade mark, is dissatisfied with the decision of the Commissioner of Patents, he may appeal to the court of appeals of the District of Columbia, on complying with the conditions required in case of an appeal from the decision of the commissioner by an applicant for patent, or a party to an interference as to an invention, and the same rules of practice and procedure shall govern in every stage of such proceedings, as far as the same may be applicable.

Sec. 10. That every registered trade mark, and every mark for the registration of which application has been made, together with the application for registration of the same, shall be assignable in connection with the good will of the business in which the mark is used. Such assignment must

be by an instrument in writing and duly acknowledged according to the laws of the country or state in which the same is executed; any such assignment shall be void as against any subsequent purchaser for a valuable consideration, without notice, unless it is recorded in the Patent Office within three months from date thereof. The commissioner shall keep a record of such assignments.

Sec. 11. That certificates of registration of trade marks shall be issued in the name of the United States of America, under the seal of the Patent Office, and shall be signed by the Commissioner of Patents, and a record thereof, together with printed copies of the drawing and statement of the applicant, shall be kept in books for that purpose. The certificate shall state the date on which the application for registration was received in the Patent Office. Certificates of registration of trade marks may be issued to the assignee of the applicant, but the assignment must first be entered of record in the Patent Office.

Written or printed copies of any records, books, papers, or drawings relating to trade marks belonging to the Patent Office, and of certificates of registration, authenticated by the seal of the Patent Office and certified by the commissioner thereof, shall be evidence in all cases wherein the originals could be evidence; and any person making application therefor and paying the fee required by law shall have certified copies thereof.

Sec. 12. That a certificate of registration shall remain in force for twenty years, except that in the case of trade marks previously registered in a foreign country such certificates shall cease to be in force on the day on which the trade mark ceases to be protected in such foreign country, and shall in no case remain in force more than twenty years, unless renewed. Certificates of registration may be from time to time renewed for like periods on payment of the renewal fees required by this act, upon request by the registrant, his legal representatives, or transferees of record in the Patent Office, and such request may be made at any time not more than six months prior to the expiration of the period for which the certificates of registration were issued or renewed. Certificates of registration in force at the date at which this act takes effect shall remain in force for the period for which they were issued, but shall be renewable on the same conditions and for the same periods as certificates issued under the provisions of this act, and when so renewed shall have the same force and effect as certificates issued under this act.

Sec. 13. That whenever any person shall deem himself injured by the registration of a trade mark in the Patent Office he may at any time apply to the Commissioner of Patents to cancel the registration thereof. The commissioner shall refer such application to the examiner in charge of interferences, who is empowered to hear and determine this question and who shall give notice thereof to the registrant. If it appear after a hearing before the examiner that the registrant was not entitled to the use of the mark at the date of his application for registration thereof, or that the mark is not used by the registrant, or has been abandoned, and the examiner shall so decide, the commissioner shall cancel the registration. Appeal may be taken to the commissioner in person from the decision of examiner of interferences.

Sec. 14. That the following shall be the rates for trade mark fees:

On filing each original application for registration of a trade mark, ten dollars: *Provided*, That an application for registration of a trade mark pending at the date of the passage of this act, and on which certificate of registration shall not have issued at such date, may, at the option of the applicant, be proceeded with and registered under the provisions of this act without the payment of further fee.

On filing each application for renewal of the registration of a trade mark, ten dollars.

On filing notice of opposition to the registration of a trade mark, ten dollars.

On an appeal from the examiner in charge of trade marks to the Commissioner of Patents, fifteen dollars.

On an appeal from the decision of the examiner in charge of interferences, awarding ownership of a trade mark or canceling the registration of a trade mark, to the Commissioner of Patents, fifteen dollars.

For certified and uncertified copies of certificates of registration and other papers, and for recording transfers and other papers, the same fees as required by law for such copies of patents and for recording assignments and other papers relating to patents.

Sec. 15. That sections forty-nine hundred and thirty-five and forty-nine hundred and thirty-six of the Revised Statutes, relating to the payment of patent fees and to the repayment of fees paid by mistake, are hereby made applicable to trade mark fees.

Sec. 16. That the registration of a trade mark under the provisions of this act shall be prima facie evidence of ownership. Any person who shall, without the consent of the owner thereof, reproduce, counterfeit, copy, or colorably imitate any such trade mark and affix the same to merchandise of substantially the same descriptive properties as those set forth in the registration, or to labels, signs, prints, packages, wrappers, or receptacles intended to be used upon or in connection with the sale of merchandise of substantially the same descriptive properties as those set forth in such registration, and shall use, or shall have used, such reproduction, counterfeit, copy, or colorable imitation in commerce among the several states, or with a foreign nation, or with the Indian tribes, shall be liable to an action for damages therefor at the suit of the owner thereof; and whenever in any such action a verdict is rendered for the plaintiff, the court may enter judgment therein for any sum above the amount found by the verdict as the actual damages, according to the circumstances of the case, not exceeding three times the amount of such verdict, together with the costs.

Sec. 17. That the circuit and territorial courts of the United States and the supreme court of the District of Columbia shall have original jurisdiction, and the circuit courts of appeal of the

United States and the court of appeals of the District of Columbia shall have appellate jurisdiction of all suits at law or in equity respecting trade marks registered in accordance with the provisions of this act, arising under the present act, without regard to the amount in controversy.

Sec. 18. That writs of certiorari may be granted by the Supreme Court of the United States for the review of cases arising under this act in the same manner as provided for patent cases by the act creating the circuit court of appeals.

Sec. 19. That the several courts vested with jurisdiction of cases arising under the present act shall have power to grant injunctions, according to the course and principles of equity, to prevent the violation of any right of the owner of a trade mark registered under this act, on such terms as the court may deem reasonable; and upon a decree being rendered in any such case for wrongful use of a trade mark the complainant shall be entitled to recover, in addition to the profits to be accounted for by the defendant, the damages the complainant has sustained thereby, and the court shall assess the same or cause the same to be assessed under its direction. The court shall have the same power to increase such damages, in its discretion, as is given by section sixteen of this act for increasing damages found by verdict in actions of law; and in assessing profits the plaintiff shall be required to prove defendant's sales only; defendant must prove all elements of cost which are claimed.

Sec. 20. That in any case involving the right to a trade mark registered in accordance with the provisions of this act, in which the verdict has been found for the plaintiff, or an injunction issued, the court may order that all labels, signs, prints, packages, wrappers, or receptacles in the possession of the defendant, bearing the trade mark of the plaintiff or complainant, or any reproduction, counterfeit, copy, or colorable imitation thereof, shall be delivered up and destroyed. Any injunction that may be granted upon hearing, after notice to the defendant, to prevent the violation of any right of the owner of a trade mark registered in accordance with the provisions of this act, by any circuit court of the United States, or by a judge thereof, may be served on the parties against whom such injunction may be granted anywhere in the United States where they may be found, and shall be operative, and may be enforced by proceedings to punish for contempt, or otherwise, by the court by which such injunction was granted, or by any other circuit court, or judge thereof, in the United States, or by the Supreme Court of the District of Columbia, or a judge thereof. The said courts, or judges thereof, shall have jurisdiction to enforce said injunction, as herein provided, as fully as if the injunction had been granted by the circuit court in which it is sought to be enforced. The clerk of the court or judge granting the injunction shall, when required to do so by the court before which application to enforce said injunction is made, transfer without delay to said court a certified copy of all the papers on which the said injunction was granted that are on file in his office.

Sec. 21. That no action or suit shall be maintained under the provisions of this act in any case when the trade mark is used in unlawful business, or upon any article injurious in itself, or which mark has been used with the design of deceiving the public in the purchase of merchandise, or has been abandoned, or upon any certificate of registration fraudulently obtained.

Sec. 22. That whenever there are interfering registered trade marks, any person interested in any one of them may have relief against the interfering registrant, and all persons interested under him, by suit in equity against the said registrant; and the court, on notice to adverse parties and other due proceedings had according to the course of equity, may adjudge and declare either of the registrations void in whole or in part according to the interest of the parties in the trade mark, and may order the certificate of registration to be delivered up to the Commissioner of Patents for cancellation.

Sec. 23. That nothing in this act shall prevent, lessen, impeach, or avoid any remedy at law or in equity which any party aggrieved by any wrongful use of any trade mark might have had if the provisions of this act had not been passed.

Sec. 24. That all applications for registration pending in the office of the Commissioner of Patents at the time of the passage of this act may be amended with a view to bringing them, and the certificate issued upon such applications, under its provisions, and the prosecution of such applications may be proceeded with under the provisions of this act.

Sec. 25. That any person who shall procure registration of a trade mark, or entry thereof, in the office of the Commissioner of Patents by a false or fraudulent declaration or representation, oral or in writing, or by any false means, shall be liable to pay any damages sustained in consequence thereof to the injured party, to be recovered by an action on the case.

Sec. 26. That the Commissioner of Patents is authorized to make rules and regulations, not inconsistent with law, for the conduct of proceedings in reference to the registration of trade marks provided for by this act.

Sec. 27. That no article of imported merchandise which shall copy or simulate the name of any domestic manufacture, or manufacturer or trader, or of any manufacturer or trader located in any foreign country which, by treaty, convention, or law affords similar privileges to citizens of the United States, or which shall copy or simulate a trade mark registered in accordance with the provisions of this act or shall bear a name or mark calculated to induce the public to believe that the article is manufactured in the United States, or that it is manufactured in any foreign country or locality other than the country or locality in which it is in fact manufactured, shall be admitted to entry at any customhouse of the United States; and, in order to aid the officers of the customs in enforcing this prohibition, any domestic manufacturer or trader, and any foreign manufacturer or trader, who is entitled under the provisions of a treaty, convention, declaration, or agreement between the United States and any foreign country to the advantages afforded by law to citizens of the United States in respect to trade marks and commercial names, may require his name and resi-

dence, and the name of the locality in which his goods are manufactured, and a copy of the certificate of registration of his trade mark, issued in accordance with the provisions of this act, to be recorded in books which shall be kept for this purpose in the Department of the Treasury, under such regulations as the Secretary of the Treasury shall prescribe, and may furnish to the department facsimilies of his name, the name of the locality in which his goods are manufactured, or of his registered trade mark; and thereupon the Secretary of the Treasury shall cause one or more copies of the same to be transmitted to each collector or other proper officer of customs.

Sec. 28. That it shall be the duty of the registrant to give notice to the public that a trade mark is registered, either by affixing thereon the words "Registered in U. S. Patent Office," or abbreviated thus, "Reg. U. S. Pat. Off.," or when, from the character or size of the trade mark, or from its manner of attachment to the article to which it is appropriated, this can not be done, then by affixing a label containing a like notice to the package or receptacle wherein the article or articles are inclosed; and in any suit for infringement by a party failing so to give notice of registration no damages shall be recovered, except on proof that the defendant was duly notified of infringement and continued the same after such notice.

Sec. 29. That in construing this act the following rules must be observed, except where the contrary intent is plainly apparent from the context thereof: The United States includes and embraces all territory which is under the jurisdiction and control of the United States. The word "States" includes and embraces the District of Columbia, the Territories of the United States, and such other territory as shall be under the jurisdiction and control of the United States. The terms "person" and "owner," and any word or term used to designate the applicant or other entitled to a benefit or privilege or rendered liable under the provisions of this act, include a firm, corporation, or association as well as a natural person. The term "applicant" and "registrant" embrace the successors and assigns of such applicant or registrant. The term "trade mark" includes any mark which is entitled to registration under the terms of this act, and whether registered or not, and a trade mark shall be deemed to be "affixed" to an article when it is placed in any manner in or upon either the article itself or the receptacle or package or upon the envelope or other thing in, by, or with which the goods are packed or inclosed or otherwise prepared for sale or distribution.

Sec. 30. That this act shall be in force and take effect April first, nineteen hundred and five. All acts and parts of acts inconsistent with this act are hereby repealed except so far as the same may apply to certificates of registration issued under the act of Congress approved March third, eighteen hundred and eighty-one, entitled, "An act to authorize the registration of trade marks and protect the same," or under the act approved August fifth, eighteen hundred and eighty-two, entitled "An act relating to the registration of trade marks."

Approved, February 20, 1905.

Act of May 4, 1906.

AN ACT to amend the laws of the United States relating to the registration of trade marks.

* * * * * * *

Sec. 2. That the Commissioner of Patents shall establish classes of merchandise for the purpose of trade mark registration, and shall determine the particular description of goods comprised in each class. On a single application for registration of a trade mark the trade mark may be registered at the option of the applicant for any or all goods upon which the mark has actually been used comprised in a single class of merchandise, provided the particular descriptions of goods be stated.

Sec. 3. That any owner of a trade mark who shall have a manufacturing establishment within the territory of the United States shall be accorded, so far as the registration and protection of trade marks used on the products of such establishment are concerned, the same rights and privileges that are accorded to owners of trade marks domiciled within the territory of the United States by the act entitled "An act to authorize the registration of trade marks used in commerce with foreign nations or among the several states or with Indian tribes, and to protect the same," approved February twentieth, nineteen hundred and five.

Sec. 4. That this act shall take effect July first, nineteen hundred and six.

Approved, May 4, 1906.

Act to Incorporate the American National Red Cross, Approved January 5, 1905

(As Amended June 23, 1910)

Sec. 4. That from and after the passage of this act it shall be unlawful for any person within the jurisdiction of the United States to falsely or fraudulently hold himself out as or represent or pretend himself to be a member of or an agent for the American National Red Cross for the purpose of soliciting, collecting, or receiving money or material; or for any person to wear or display the sign of the Red Cross or any insignia colored in imitation thereof for the fraudulent purpose of inducing the belief that he is a member of or an agent for the American National Red Cross. It shall be unlawful for any person, corporation, or association other than the American National Red Cross and its duly authorized employees and agents and the Army and Navy sanitary and hospital authorities of the United States, for the purpose of trade or as an advertisement, to induce the sale of any article whatsoever or for any business or charitable purpose to use within the territory of the United States of America and its exterior possessions the emblem of the Greek Red Cross on a white ground, or any sign or insignia made or colored in imitation thereof, or of the words "Red Cross"

or "Geneva Cross" or any combination of these words: *Provided, however*, That no person, corporation, or association that actually used or whose assignor actually used the said emblem, sign, insignia, or words for any lawful purpose prior to January fifth, nineteen hundred and five, shall be deemed forbidden by this act to continue the use thereof for the same purpose and for the same class of goods. If any person violates the provision of this section he shall be deemed guilty of a misdemeanor, and upon conviction in any Federal court shall be liable to a fine of not less than one or more than five hundred dollars, or imprisonment for a term not exceeding one year, or both, for each and every offence.

* * * * * *

Sec. 8. That the endowment fund of the American National Red Cross shall be kept and invested under the management and control of a board of nine trustees, who shall be elected from time to time by the incorporators and their successors under such regulations regarding terms and tenure of office, accountability, and expense as said incorporators and successors shall prescribe.

Approved, June 23, 1910.

An act was passed at the 1912 session of the Philippine Legislature providing for the registration and protection of patents and trade marks in the Philippine Islands. Any patent or trade mark registered in the United States Patent Office, upon being filed in the Executive Bureau of the Philippines, shall receive the same protection as is accorded in the United States, and persons infringing such patent or trade mark shall be liable to the same penalties, provided the rights of property in patents and trade marks secured in the Philippine Islands under the Spanish laws shall be respected as if such laws were in full force and effect. To file a patent for protection, a certified copy of the patent shall be sent, with a fee of two pesos ($1) and a letter of transmittal, to the chief of the division of archives, patents, copyrights, and trade marks, of the Executive Bureau of the Philippine Islands. A certified copy of a patent may be filed by another than the owner of the patent if such agent is given power of attorney. Assignments of patents may be filed in the same manner. Any questions arising under this act shall be determined by courts of first instance of the supreme court of the Philippines. This law became effective February 10, 1913.

National Canners' Association Will Make Searches

The National Canners' Association has arranged to make, without charge other than regular membership and general dues, a search of the records of the United States Patent Office as to the registerability of a trade mark or copyrighting label or print.

They state: "In case it shall be decided by the applicant to enter application for registration of a trade mark, the cost, including the expense of an India ink drawing showing the mark, is fifteen dollars; the government fee for the same is ten dollars, making a total cost of twenty-five dollars.

"For preparing and prosecuting an application for copyrighting a label or print the cost is ten dollars; the government fee for copyrighting a label or print is six dollars, making a total cost of sixten dollars.

"From the above it will be seen that where there is no interference or opposition, the cost of registering a trade mark, including the government fee, is $25; and the total expense for copyrighting a label or print under the same conditions is $16."

Foreign Trade Mark Registration

Any manufacturer or trade mark user doing an export business must take care of the question of the protection of trade marks in all foreign countries with which he does business, as in most countries registration is dependent upon ownership and not on priority of use.

The piracy of trade marks has unfortunately been common in the past in Cuba, Argentine Republic, and even in European countries an agent for an American manu-

facturer will frequently register a trade mark in his own name, and on the expiration of his agency will put his principal to great expense, embarrassment and trouble, and sometimes will cause practical confiscation of his product.

There are agencies and attorneys who specialize in the registering of trade marks in the United States and foreign countries, and it would be well for the American owner to place his business in the hands of such, especially in connection with foreign registration, as each country has its own special law covering this matter.

INDEX

THE AMERICAN CAN COMPANY is in a position to furnish canners of sea food products the most complete and varied lines of containers made. Our equipment permits the manufacture of not only an endless variety in styles of cans, but every desirable commercial size demanded by the trade.

Salmon ends for canners in Alaska or elsewhere who make their own cans from our machinery.

Closing machines for closing cans.

Collapsed and reformed cans shipped in knockdown, and equipment for assembling cans at canner's factory.

Factories located at convenient shipping points, allowing low transportation charges and prompt deliveries.

Details specifying the various cans and shipping points of their manufacture may be found on the two following pages.

AMERICAN CAN COMPANY

GENERAL OFFICES

120 Broadway, New York

AMERICAN CAN COMPANY

120 Broadway, New York

Herewith are listed the standard sizes of cans generally used for sea food products, and the factory locations where manufactured.

CAVIAR CANS

MADE AT FAIRPORT, N. Y.

1½ oz.	2⅜ x 1 1/16
3 oz.	2⅜ x 1⅞
½ lb.	2⅞ x 2½
1 lb.	2⅞ x 3 13/16

CLAM CANS

MADE AT FAIRPORT, N. Y.

5 oz.	2 11/16 x 4
8 oz.	2 15/16 x 4 9/16
8½ oz.	3 7/16 x 4
10 oz.	3 7/16 x 4 9/16

MADE AT PORTLAND, ORE.

No. ½	2⅜ x 2
No. 1	2 11/16 x 4
No. 1 Tall	3 x 4 31/32
No. 2	3 7/16 x 4½
No. 10	6 3/16 x 6 15/16

COD FISH CANS

MADE AT FAIRPORT, N. Y.

No. 13	2 13/16 x 3⅛
No. 93	3 7/16 x 3⅛

LOBSTER CANS

MADE AT NIAGARA FALLS, ONTARIO

¼ lb. Flat	2 15/16 x 1½
½ lb. Flat	3 7/16 x 2
¾ lb. Flat	4¼ x 1⅞
1 lb. Flat	4¼ x 2¼
1 lb. Tall	2 15/16 x 4 9/16

OVAL CANS

MADE AT BOSTON, MASS.

Small	5⅞ x 3½ x 1 3/16
Spec. Small	5⅞ x 3½ x 1 7/16
Medium	5⅞ x 3½ x 1¾
Large	6 9/16 x 4 9/16 x 1½
Marshall	7½ x 4 7/16 x 1 11/16

MADE AT PORTLAND, ORE., VANCOUVER, B.C., SAN FRANCISCO, CAL., AND LOS ANGELES, CAL.

½ lb. Oval
1 lb. Oval

AMERICAN CAN COMPANY

AMERICAN CAN COMPANY

120 Broadway, New York

OYSTER CANS

MADE AT BALTO, MD., AND NEW ORLEANS, LA.

3 oz	$2\frac{11}{16} \times 2\frac{3}{4}$
4 oz	$2\frac{11}{16} \times 3\frac{3}{8}$
5 oz	$2\frac{11}{16} \times 4$
6 oz	$2\frac{11}{16} \times 4\frac{5}{16}$
6 oz	$3\frac{7}{16} \times 3\frac{5}{16}$
8 oz	$3\frac{7}{16} \times 3\frac{15}{16}$
10 oz	$3\frac{7}{16} \times 4\frac{9}{16}$
12 oz	$3\frac{7}{16} \times 4\frac{7}{8}$

SARDINE CANS

MADE AT BOSTON, MASS., AND LUBEC, ME.

¼ Oil Drawn
¼ Oil Mustard Drawn
¾ Mustard - 3 pieced Can

MADE AT EASTPORT, ME., AND LOS ANGELES, CAL.

¼ Oil R. T. Key Opening
¾ Mustard R. T. Key Opening

SALMON CANS

MADE AT PORTLAND, ORE., AND SEATTLE, WASH.

No. 1 Tall	$3 \times 4\frac{31}{32}$
1 lb. Flat C. R.	$4\frac{1}{16} \times 2\frac{5}{8}$
½ lb. Flat C. R.	$3\frac{3}{8} \times 2$
1 lb. Flat Alaska	$4\frac{1}{16} \times 2\frac{11}{16}$
½ lb. Flat Alaska	$3\frac{3}{8} \times 2\frac{1}{8}$
1 lb. Flat P. A.	$4\frac{1}{16} \times 2\frac{11}{16}$
½ lb. Flat P. A.	$3\frac{3}{8} \times 2\frac{1}{8}$

SHRIMP CANS

MADE AT NEW ORLEANS, LA.

No. 1	$2\frac{11}{16} \times 4$
No. 1½	$3\frac{7}{16} \times 3\frac{15}{16}$
No. 2	$3\frac{7}{16} \times 4\frac{9}{16}$

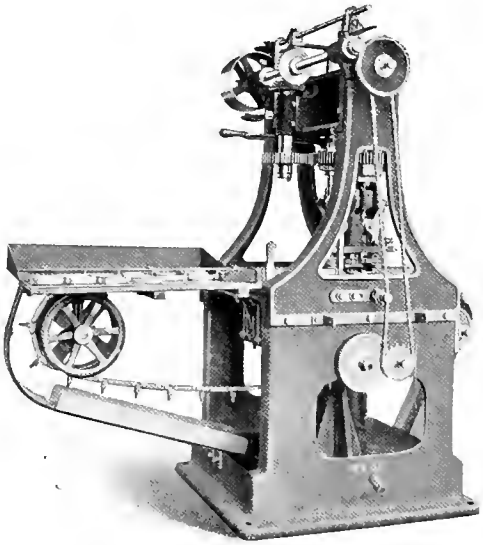
TUNA CANS

MADE AT LOS ANGELES, CAL.

¼	$2\frac{11}{16} \times 1\frac{3}{4}$
½	$3\frac{3}{8} \times 2$
No. 1	$4 \times 2\frac{3}{8}$

In addition to the above sizes of cans for sea foods, the American Can Company manufactures every sort of container—metal or fibre—for any desired purpose. Correspondence is solicited not only from those engaged in business but also from those contemplating placing on the market any sort of package goods.

AMERICAN CAN COMPANY



No. 32 DOUBLE SEAMER
For closing ¼ and ½ oil cans.

"AMS" Double Seamers

WE ARE NOW PREPARED TO FURNISH AUTOMATIC CLOSING MACHINES FOR ROUND CANS, GIVING ANY DESIRED OUTPUT FROM **50** TO **200** CANS PER MINUTE

THE MAX AMS MACHINE CO.

CHAS. M. AMS, President

NEW YORK, N. Y.

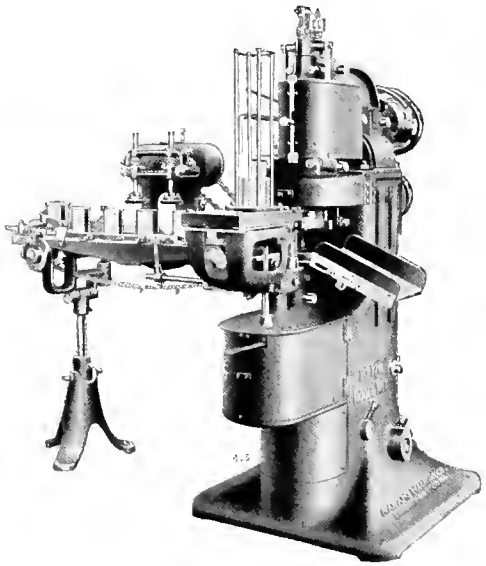
COAST DISTRIBUTORS:

THE PREMIER MACHINERY CO.

SAN FRANCISCO., CAL.

THE SEAL

OF SAFETY



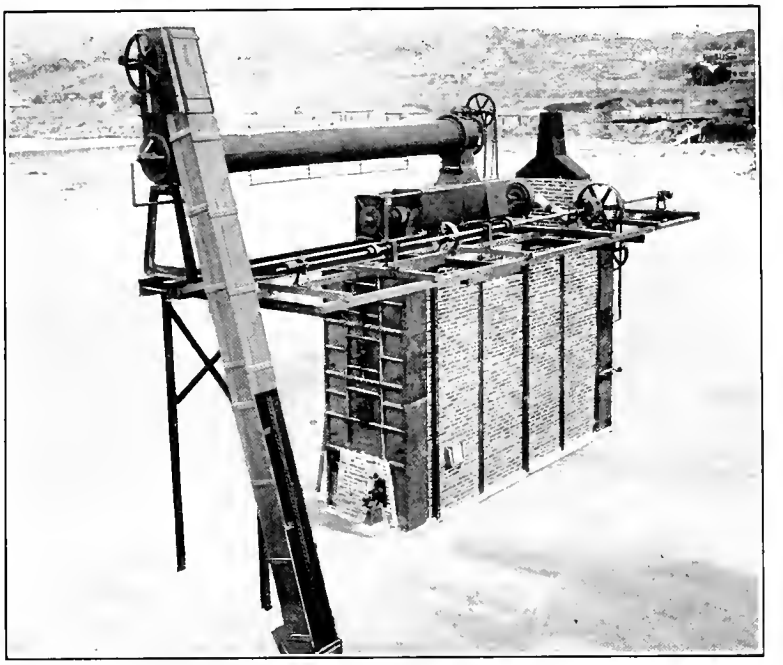
No. 128 DOUBLE SEAMER
For round cans—60-70 per minute.

Turn Your Waste Into Profit

Our Fishmeal Plants accomplish this in a clean, sanitary, odorless manner.

These plants have been installed in the center of residence districts and cause no complaint.

Any Capacity Any Kind of Fish Any Fuel



Can be Installed in Unused Part of Cannery or on a Wharf

PATENTS PENDING

The operation is continuous and automatic and requires only one man on the smaller plants and two on the larger ones to operate, and the power needed is very small.

The products, Fishmeal and Oil, are becoming more used every day, and the profits from the manufacture of them are getting greater.

If your offal is a problem to you, let us show you how to convert it into a profit.

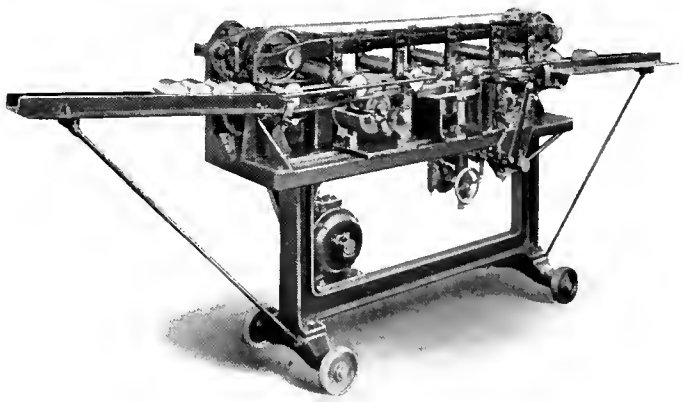
The entire plant is tested before leaving our factory, and is shipped K. D.

For all particulars, cuts, catalogs, etc., address

CALIFORNIA PRESS MFG. CO.

409 Sixth Street San Francisco

World Can Labeler



¶ Easily adjustable for different sizes of cans.

¶ Uses one kind of gum for pick-up and lap.

¶ Each can neatly labeled. No waste of labels.

¶ Backed by an organization well known for its lively and continuous interest in satisfying the users of its products.

It Will Pay You to Investigate This Machine

Economic Machinery Company

WORCESTER, MASSACHUSETTS

Troyer-Fox

Sanitary Seaming or Closing Machines

FOR SEALING
and
PRESERVING

All FISH, MEAT, VEGETABLE and other food products by the sanitary process of sealing the end to the flanged body of the can by the double roll or seam, interlined with a rubber cement.

SPEED—75 to 90 Cans Per Minute

NO SPILLS—NO LEAKS—NO JAMMED CANS

An automatic spiral can feed. No can, no top, end feed. Two seaming operations, can standing still. Seaming rolls—heat treated tool steel—that stay in adjustment.

Write for catalog.

Seattle-Astoria Iron Works

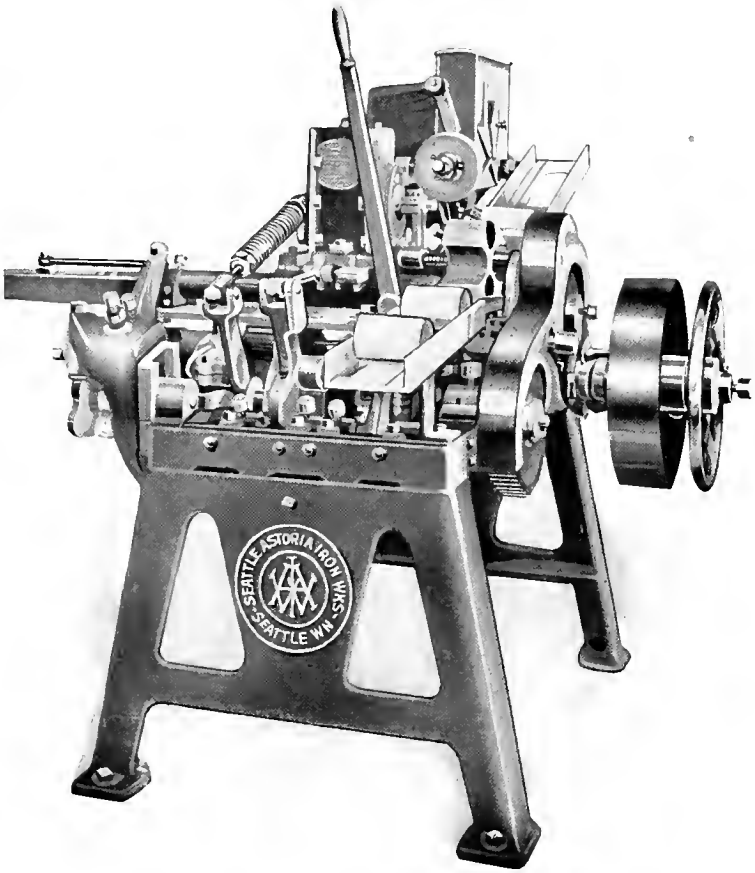
Builders of

TROYER-FOX Sanitary Can Making and Canners' Machinery

SEATTLE, WASH.

TROYER-FOX

Automatic Sanitary Salmon Canning Machinery



IMPROVED JENSEN PATENT AUTOMATIC FILLERS

For 1 inch Tall, 1 inch Flat and ½ inch Flat.
Speed 75 to 90 cans per minute.

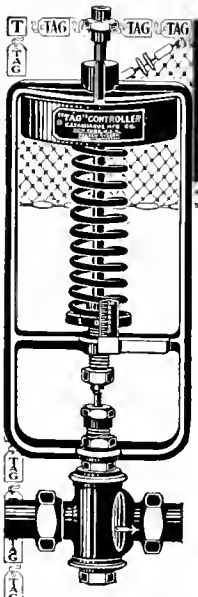
THIRTY-EIGHT years specializing in designing and building salmon canners' machinery. Close intimate touch with every phase of the business.

Standard equipment for every operation from the water to the can.

Send for catalog illustrating, describing and giving detailed specifications.

SEATTLE-ASTORIA IRON WORKS

Builders of
TROYER-FOX Sanitary Can Making and Canners' Machinery
SEATTLE, WASH.



"Set it and Forget it"

The fish-net will NET YOU MORE IF

your pack has been processed in kettles equipped with TAG Self-Operating Retort Controllers because the costly item of *spoilage* is then reduced to the minimum.

You know from experience that even a small proportion of spoiled cans (due to under- or over-cooking) greatly depreciates the value of the pack—and represents a large percentage of your *net* profits.

TAG Self-Operating Retort Controllers

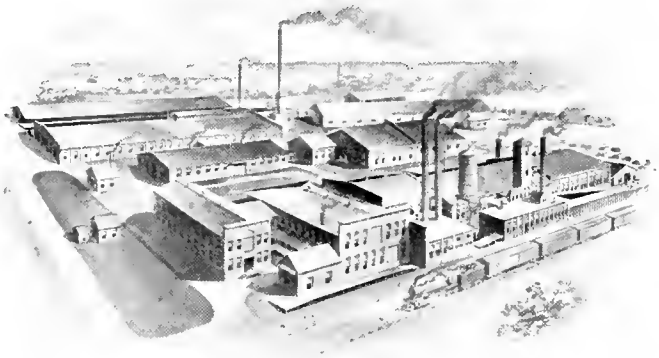
are the simplest and surest solution because by automatically maintaining a *uniform* temperature within the kettles, UNIFORM processing is always achieved.

This is only one of the reasons why TAG Controllers are rapidly replacing unreliable and wasteful hand manipulation of the steam inlet valves, also other makeshifts.

No auxiliary motive power is required so that TAG Controllers are simple to install and operate. Moreover, they quickly pay for themselves in the items of spoilage, labor and steam.

If you'd like your "fish net to net you more", ask for Bulletin F-386

C.J. TAGLIABUE MFG.CO.
TEMPERATURE ENGINEERS
18-88 Thirty-Third St. Brooklyn, N.Y.



SPRAGUE WORKS

The Home of the Sign of Quality

BUILDERS OF

COMPLETE EQUIPMENT FOR CANNING AND PRESERVING PLANTS

The only manufacturers who are prepared to supply your requirements in canning factory machinery, complete in every detail, backed up by thirty years of experience and a money-back guarantee of satisfaction.

Sprague Canning Machinery Company

FACTORY: HOOPESTON, ILL. **GENERAL OFFICES: CHICAGO, ILL.**

EASTERN BRANCH:
SHEPPARD SUPPLY & EQUIPMENT CO.
37 South Charles Street
Baltimore, Md.

WESTERN AGENTS:
PREMIER MACHINERY CO.
16 California Street
San Francisco, Calif.

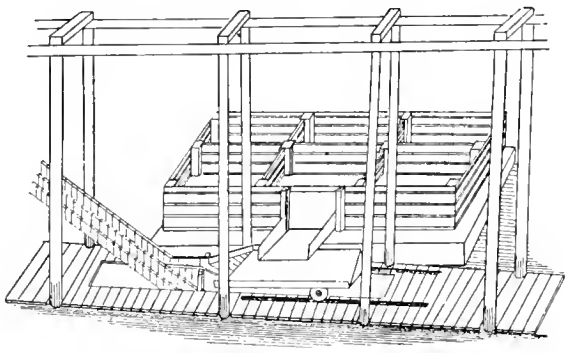
Salmon Canners

Why Pay for High Priced Labor to Unload Your Scows?

They will UNLOAD THEMSELVES if Equipped with the

HOONAH AUTOMATIC FISH CONVEYOR SYSTEM

Patent No. 126246—Issued April 19, 1918



SKETCH OF HOONAH SCOW BESIDE CANNERY FLOAT

One Man Can Do The Work of Six

Under average operating conditions, one man working ten hours a day last year did all work connected with unloading and washing scows at the four-line Hoonah Cannery, which packed 101,000 cases in 26 consecutive days.

Conserve Money and Man Power! The Country Needs Them!

HOONAH PACKING CO.

SOUTH BELLINGHAM, WASH.

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Brokers and Commission Merchants

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Canned Foods, Dried Fruits, Beans, California Products, Salmon

REFERENCES:

Irving National Bank

Fidelity Trust Co.

Broadway Trust Co.