42.—NOTES ON THE FISHERIES AND THE FISHERY INDUSTRIES OF PUGET SOUND.

BY JAMES G. SWAN.

ON THE ECONOMIC VALUE OF THE GIANT KELP AND OTHER SEAWEEDS OF THE NORTHWEST COAST OF NORTH AMERICA.

The giant kelp, which lines the shores of the northwest coast, is the *Nereocystis* of the order of *Laminariaceæ*. Harvey, in his Nereis Boreali Americana* thus describes this species:

> Olive-colored, inarticulate seaweeds, usually tough and leathery in substance. The plants of this order are almost always large, frequently of gigantic size, with a solid cylindrical stem, which expands into a hollow cylinder or tube, terminating in a globular head, from which fronds or aprons float on the surface of the water.

The *Nereocystis* of the northwest coast is said, when fully grown, to have a stem measuring 300 feet in length, which bears at its summit an air bulb, from which a tuft of upwards of fifty long, streamer-like leaves extend, each of which is from 30 to 40 feet in length. The stem, which anchors this floating mass, though no thicker than a common window cord, is of great strength and flexibility and has for ages been used by the natives as fishing lines, being first cut of the required length, which is where the stem begins to expand into the hollow tube, and varies from 10 to 15 fathoms, then soaked in fresh water in a running brook until it is nearly bleached, then stretched, rubbed to the required size, and dried in the smoke in the lodge. When dried, it is very brittle, but when wet, it is exceedingly strong, and equal to the best flax or cotton fishing lines of the white fishermen.

These pieces, varying from 10 to 15 fathoms each, are knotted together to the required length of 80 fathoms, required in the deep-water fishing around the entrance to Fuca Strait, or 200 fathoms at Queen Charlotte Islands, British Columbia, where the natives take the black cod at that profound depth.

Until within a few years the coast Indians used the upper or hollow portion of these great kelp stems as receptacles for holding dogfish oil which, together with the paunches of seals and sea lions and whale gut, properly prepared, were the utensils found in every house for holding the family supplies of whale, seal, or salmon oil which are used as articles of food, or for dogfish oil which is used for trading purposes only. Now, however, the Indians use coal-oil cans, barrels, and other utensils easily procured from the white traders, and the use of kelp for holding oil is nearly abandoned.

*Smithsonian Contributions to Knowledge, May, 1858.

Among my collections for the National Museum in 1885, I received a number of specimens of this kelp which had been used for dogfish oil. I split one open and found that the oil had hardened the inside of the kelp tube to the consistency of leather. This specimen I washed with soap and water, then wiped it to remove the moisture, and then rubbed and manipulated it after the manner used by natives in dressing deer skins, and when perfectly dry by this process of continual rubbing, it was soft and flexible, presenting an appearance of wash leather, but if allowed to dry without manipulation it would be hard and brittle. A party of coast Indians were camped on the beach at Port Townsend, and, at my request, they showed me their method of preparing kelp for holding oil. The great stems of the *Nereocystis* are covered with a thin coating of silex, which is carefully peeled off as one might peel the skin from an apple; only the hollow or upper part of the stem is used. When the skin is removed the tube is placed above the fire and smoked in the lodge, and, as it dries, the salt it contains exudes on the surface; this is carefully removed by rubbing, which also serves to soften the kelp and render it pliable. It is then again placed over the fire, and the process continued until the salt is removed; then the tube is blown up like a bladder and allowed to dry until it will retain its shape, and it is then filled with dogfish oil and is ready for market.

The rude and simple experiments I made with this giant kelp convinced me that it is capable of being converted into articles of commercial value, but as I had not the means of conducting experiments or of procuring the machinery requisite to the manufacture of the kelp products on a scale of commercial importance, I have allowed the matter to rest until some one of enterprise and capital may be found, ready to continue these investigations.

In order to show those who may feel interested in the development of this new industry, I will quote from a valuable and exhaustive paper "on the economic applications of sea weed," by Edward C. C. Stanford, F. C. S., read before the Society of Arts, London, England, May 22, 1884.

Sea weed as food.—In Great Britain little advance has been made in the use of algæ as food. The algæ contain important nitrogenous constituents and form nutritious articles of diet, but they have not been popular. We all like the smell of the sea air, but we do not cultivate a taste for our marine vegetables. The algæ, so far as known, contain no poisonous species. Among the edible varieties, *Ulva latissima*, or green laver, and *Porphyra lacinata*, or pink laver, are occasionally used in soups. *Rhodomenia palmata*, or dulse, is still sold in the streets of Edinburgh and Glasgow. *Aliara esculenta*, or murlins, is also eaten in Ireland. Some others are occasionally used, but as a general food the algæ are almost unknown.

The best-known British species of the edible algæ is the *Chrondus crispus*, or Irish moss; this grows far down on the rocks and is only uncovered at low spring tides. It is obtained mostly from the west coast of Ireland, and after being bleached by exposure to sun and rain is largely exported to England, Germany, and the United States. It is a gelatinous species containing a principle known as *carragheenin*.

The only other gelatinous British species is the *Gelideum corneum*. This is not very common, but furnishes the import known as Japanese isinglass, of which it contains 50 per cent. This substance, known also as gelose, was first imported into France from China in 1856; it has great gelatinizing powers, much higher than any other material; gelose has eight times the gelatinizing power of isinglass and gelatine, but

the melting-point of the jelly is too high to melt quickly in the mouth, hence gelatine is still the favorite. The *Chrondus crispus* is found on the Atlantic coast and forms one of the industries of Cape Cod; it is also found on the Pacific coast from Cape Flattery to Alaska.

The green and pink laver and dulse are common, and constitute an article of diet of the Haida Indians of Queen Charlotte Islands and other tribes on the Northwest coast, who prepare these seaweeds by drying and pressing them into compact blocks. When required for food, these blocks are sliced with a sharp knife, then soaked in fresh water and boiled. The algæ are not in general use among all the tribes of the northwest coast, but they form a large article of food consumption in China and Japan.

The taste for marine vegetables must be acquired, but those who have eaten of them are said to become very fond of them, and some gentlemen in the Highlands of Scotland, personally known to Mr. Stanford "as no mean judges of diet, consider a dish of dulse boiled in milk the best of all vegetables." There is no doubt that a valuable food is lost in entirely neglecting the algæ. I have partaken of a meal of dulse boiled with halibut by the Haida Indians while on Queen Charlotte Islands, in 1883, and I found it very palatable. In Alaska and British Columbia the deer are fond of the sea mosses, and during the long run out of spring tides they eagerly browse the marine vegetable. Cows and pigs also eagerly eat the *Chrondus crispus*, and it has long been used by white people under its name of Irish moss.

The manufacture of seaweed.—The crude substance, which for many years made the Highland estates so very valuable, was first manufactured from kelp as the principal source of carbonate of soda. At the beginning of this century it realized from $100 to $120 per ton, and the Hebrides alone produced 20,000 tons per annum. The importation of barilla from the Mediterranean then began and the price fell in 1831 to $10 per ton. It was used, up to 1845, in the soap and glass works of Glasgow, until it was entirely superseded by the soda process of Le Blanc.

The manufacture of iodine and potash salts then began to assume some importance, but the kelp required was not the same; that which contained the most soda contained the least iodine and potash. Bromine is also extracted from kelp, but the amount is small and is not considered worth extracting, as large quantities are now produced in Germany and in this country from other sources.

The amount of iodine in sea water is so minute that it is extremely difficult to detect by ordinary tests, but the algæ possess the power of assimilating the iodine to about ten times the extent of the bromine. It is probable that all animal substances from the sea contain iodine; its presence has been very long known in cod-liver oil, but it is very small; the liver itself contains double as much, and fresh cod liver nicely fried has long been considered excellent in pulmonary complaints.

Algin, a new gelatinous substance.—All the algæ are cellular and contain no fiber, but properly treated they make a tough, transparent paper, which can be printed or written upon, like parchment. Stanford thus explains his process of extracting this substance:

If the long fronds of the *Laminaria stenophylla* be observed after exposure to rain, a tumid appearance will be noticed, and sacs of fluid are formed from the endomosis of the water through the membrane, dissolving a peculiar glutinous principle. If the sacs be cut, a neutral, glairy, colorless fluid escapes. It may often be seen partially evaporated on the frond as a colorless jelly. This substance, which is insoluble

in water, is the remarkable body to which is given the name of algin. The natural liquid itself is miscible with water, but is coagulated by alcohol and by mineral acids. It contains calcium, magnesium, and sodium, in combination with a new acid, called alginic acid. When this natural liquid is evaporated to dryness it becomes insoluble in water, but is very soluble in alkalies.

This new substance is so abundant in the plant that on maceration for twenty-four hours in sodium carbonate in the cold the plant is completely disintegrated. The mass thus obtained is a glutinous mass of great viscosity, and difficult to deal with on that account. It consists of the cellulose of the plant mixed with sodium alginate. The cells are so small that they pass through many filters, but by cautiously heating it the mass can be filtered through a rough linen filter bag, the cellulose being left behind; and after the algin is removed this is easily pressed.

The solution contains dextrine and other extractive matter, and it is then precipitated by hydrocloric or sulphuric acid; the alginic acid precipitates in light gray albuminous flocks, and is easily washed and pressed in an ordinary wooden screw-press. It forms a compact cake resembling new cheese, and has only to be stored in an ordinary cool drying-room, where it can be kept any length of time. If desired, by adding a little bleach during the precipitation, it can be obtained perfectly white. The algin can be sent out in this state. It is only necessary to dissolve it in sodium carbonate in the cold for use. If, however, it be sent out as sodium alginate, it must be dissolved to saturation in sodium carbonate. The carbonic acid is disengaged and sodium alginate is formed. If potassium or ammonium carbonate be used the alginates of potassium or ammonium are formed, which are similar to the soda salt. The bicarbonates of these alkalis may also be used, but the caustic alkalis are not such good solvents.

The sodium alginate forms a thick solution at 2 per cent; it can not be made over 5 per cent, and will not pour at that strength. Its viscosity is extraordinary. It was compared with well-boiled wheat starch and with gum arabic in an ordinary viscometer tube. The strengths employed were as follows. It was found impossible to make the algin run at all over the strength employed:

	Seconds.
Gum arabic solution, 25 per cent, took 75	1 in 3
Wheat starch solution, 1·5 per cent, took 25	1 in 8
Algin solution, 1·25 per cent, took 140	*1 in 112*

So that algin has 14 times the viscosity of starch and 37 times that of gum arabic.

The evaporation is effected in a similar manner to that of gelatin, in thin layers on trays or slate shelves, in a drying room, with a current of air or on revolving cylinders heated internally by steam. High temperature must be avoided. The solution keeps well. Thus obtained, sodium alginate presents the form of thin, almost colorless sheets resembling gelatin, but very flexible. These sheets can be written upon or printed. It is said that in some parts of Japan this substance, which is translucent, has been used instead of glass to admit light to the dwellings of the poorer classes. It has several remarkable properties which distinguish it from all other known substances. It is distinguished from albumen, which it most resembles, by not coagulating on heating, and from gelose by not gelatinating on cooling; from gelatin by giving no reaction with tannin; from starch, by giving no color with iodine; from dextrin, gum arabic, pectin, and tragacanth, by its insolubility in dilute alcohol and dilute mineral acids.

The aluminum alginate is soluble in caustic soda, forming a neutral solution and giving on evaporation a substance like algin, but harder and making a stiffer finish. It is also soluble in ammonia, the salt becoming an insoluble varnish on evaporation.

The alginates of copper (*blue*), nickel (*green*), cobalt (*red*), chromium (*green*), are all soluble in ammonia and form beautiful, colored, insoluble varnish on evaporation.

Commercial application of algin or sodium alginate.—Algin being a soluble gum of considerable elasticity and flexibility is a great desideratum, and as a soluble substitute for albumen, which can easily be rendered soluble and used as a mordant, it is a valuable production.

As a finish, algin has the advantage over starch that it fills the cloth better, is tougher and more elastic, that it is transparent when dry, is not acted upon by acids, and it imparts to the goods a thick, clothy, elastic feeling without the stiffness imparted by starch. It has been used as a mordant in dyeing turkey red with remarkable success. The mordants when precipitated seem to have full dyeing powers, the results indicating that the substance is capable of taking the place of cow dung as used in print and dye works.

As an article of food.—Algin contains carbon, 44·39; hydrogen, 5·47; nitrogen, 3·77; oxygen, 46·37; or about the same amount of nitrogen found in Dutch cheese. It has a pleasant marine taste, easily overcome if objected to, and may form a useful addition to the kitchen for thickening soups and puddings. It appears specially adapted to replace gum arabic in the manufacture of jujubes and lozenges. To make into jelly requires addition of glucose or gelatin or admixture of lemon juice.

For boiler incrustations.—The sodium alginate has a remarkable effect on resolving and preventing the incrustation of boilers. It precipitates the lime in a state in which it can be easily blown off. The solution is pumped in with the feed water in the proportion of 1 pound to every 1,000 gallons; when hard waters are a necessity the saving of fuel is considerable. For salt-water boilers the sodium alginate is valuable and should be fully investigated.

Algic cellulose.—This substance bleaches easily, and under pressure becomes very hard, and can be turned and polished with facility. It also makes a good paper, tough and transparent, but with no fiber.

The process of extracting the algin and the cellulose utilizes the whole plant, and we obtain two new products of considerable commercial importance. The process is extremely simple, as already described, being a maceration of the plant for twenty-four hours in a solution of sodium carbonate in the cold; then filter and press. This operation does not require an extravagant plant, nor do operations on a large scale present any serious practical difficulties. The algæ of the Pacific coast are in such enormous quantities that the rudest kind of a building for shelter could be erected anywhere on the coast, or on Puget Sound near to the extensive fields of kelp, where it could be easily gathered at small expense and macerated in fresh-water solution of sodium carbonate, filtered, pressed, and made ready for the manufacturers.

During a residence of many years in the vicinity of Cape Flattery, at the entrance of Fuca Strait, I have had ample time and opportunity to observe the great masses of the giant kelp and other marine plants, which are torn up by the roots every fall by the storms, and piled by the waves along the beach at Neah Bay. I have frequently noticed, when a mass of this kelp has been thrown into a pool of fresh water, that in a few days it is covered with this slippery substance which Stanford has named algin,

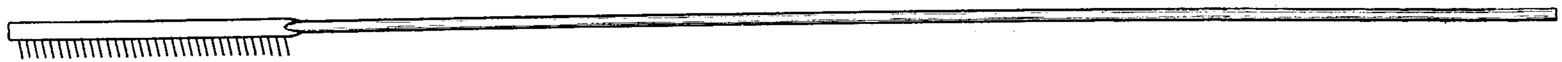
and I think that the *Nereocystis* is rich with this valuable ingredient. The supply of the raw material is practically unlimited, and if attention shall be directed to the valuable uses to which this plant and other algæ may be put, I feel confident that a new and important industry will be developed, and we would all share in the satisfaction of knowing that one more waste product of the ocean can be effectually utilized.

METHODS OF SECURING HERRINGS, SMELT, AND SARDINES AT PORT TOWNSEND, WASHINGTON.

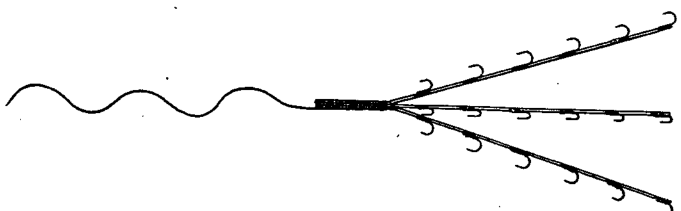
The water of Port Townsend Harbor is as clear and transparent as the ocean. The only stream flowing into it is the Chemakum Creek, a small fresh-water brook at the southern end of the bay; the water of this creek is of too small volume and not sufficiently rapid to bring down muddy water and its effects are imperceptible, and the salt water of the bay varies but little in density and temperature from the ocean water at Cape Flattery, a hundred miles west of Port Townsend, and as a consequence the ocean fish, in their season, crowd in great masses into the bay and around the wharves where the clear water enables persons standing on the wharf to distinctly see objects at a depth of 25 to 30 feet.

On a clear still day it is interesting to look down into the transparent water and view the myriads of fish. Cod and salmon abound in the spring and are easily caught with hook and line. The favorite bait for cod is a peculiar kind of a marine worm, which grows in clusters around the piles of the wharf; the bait for salmon is fresh herring. Cod and salmon swim the deepest and can be seen far down below the surface. Above them are the rockfish, then nearer the surface are herring, smelt, and anchovies or sardines. These are in such dense masses or schools that at times the water seems literally packed with them. Then the Indian comes slowly paddling his canoe and ever and anon making a dip with his fish-rake. This consists of a stout pole 15 or 16 feet long, with its lower end flattened like the blade of a paddle, into the edges of which are inserted a row of wooden pegs sharpened, or stout wire. The Indian takes the rake with both hands, as near the top as he can work, then reaches forward as far as he can and makes a swift stroke with the implement through the schools of fish, bringing it up behind him, and with a jerk he shakes off the fish which have been impaled on the sharp points or teeth of his fish-rake and they fall into the canoe. He will bring up from one to a dozen or twenty fish at a stroke, and keeps up the work until his canoe is full. This method has been used by Puget Sound Indians for generations before white men came among them, and long before the use of nets and fishing lines was made known to them, and is still a favorite method for procuring bait. They have, however, acquired the knowledge of making nets, and are expert in making nets and fish lines.

Formerly the twine for making nets was made of the fiber of the common nettle, and finer thread was made from the *Epilobium angustifolum*, or fireweed, so common all over the North American continent. The use of these materials seems to be abandoned at present, and is only found among some of the out-of-the-way bands of natives on the coast, where occasionally an old woman may be found who prefers to make and use the same material for threads as her ancestors used before the historic



HERRING AND SMELT RAKE USED BY INDIANS OF PUGET SOUND.



WIRE JIGGER ATTACHED TO FISH LINE.

FISH-LINE JIGGER.

period; but twine and ready-made nets of the whites have superseded the primitive method, as hemp and cotton fish-lines have superseded the use of kelp lines made of the *Nereocystis* or giant kelp of the Northwest coast.

As herring, sardines, and smelt do not bite at baited hooks in these waters, the fishermen and boys that usually find sport or profit in fishing from wharves were not slow to adopt the Indian method of impaling them on the sharp points of fish-rakes. The Indian implement was found to be too clumsy to be used from the wharf, so a method was adopted of securing fish-hooks to lines, or to wires, which are termed jiggers. These are attached to fishing-rods. When used, the jigger is thrown out as far as it can reach and is then pulled swiftly through the masses of fish and is sure to impale several on the sharp hooks.

One instrument I have seen was formed of wires which would open and close like the ribs of an umbrella. This, when closed, would be lowered through a school of fish and when suddenly hauled up the wires would expand, and as each wire had a number of hooks attached to it a rich harvest was the result. This jigger method is a pot-hunter's plan, and is neither scientific from an angler's point of view nor does it have any other recommendation than that a hungry man can procure his breakfast with a few casts of a jigger into the dense schools of fish; but as the fish are more or less lacerated by this plan they are only fit for immediate consumption, and "jiggered" fish are not offered for sale by fish-dealers.

The smelt are taken for market by nets. They abound in Scow Bay or Long Harbor opposite Port Townsend, and the market is supplied by the fishermen who reside there, who are mostly Portuguese. These smelt are taken nearly every month in the year; they are of superior quality and very plentiful, but I never have seen them taken with hooks like the smelt of the Atlantic. The only way they are taken from the wharves is by these jiggers. The so-called black bass (*Sebastichthys*) is very plentiful and forms excellent sport. It is a game fish and fine eating, and at times is taken by the disciples of Izaak Walton with rod and reel, especially at night, in great quantities.

The bait used by these rod fishermen is either minnows, marine worms, salmon eggs, or fresh meat. The rod fishing for salmon from the wharves is excellent sport, and when salmon are running it is quite an attractive sight to see these fine fish landed in numbers on the wharves.

The anchovy are taken with smelt and herring in landing seines, but when a special fishery is established for these delicious fish they will be taken with purse nets in deep water where they school like mackerel.

This jigger system, which I have explained, is a proof of the enormous quantities of these fish in the waters of Puget Sound. Where fish are scarce the jigger is of little account and seldom used, but when the fish mass in myriads about the wharves the jigger is very effective.

ON THE SARDINE FISHERY OF PUGET SOUND.

The fish known on Puget Sound as sardines are not the *Clupea sagax*, or California sardine, but are the *Stolephorus ringens*, or anchovy. Of the California sardine, Prof. Jordan writes:*

This species is everywhere known as the sardine, or, by the Italians, as "sardinia." It is, in fact, almost exactly identical with the sardine of Europe. It reaches a length of a little less than a foot. It ranges from Cape Mendocino to Chile, and is abundant south of San Francisco, especially in the winter, when it fills all the bays. In the summer it is scarce southwardly, although still taken northward. The young are, however, seen in San Diego in the summer. It is probably to some extent migratory along the coast, but as little attention is paid to it no definite data can be given. It is brought into the market when taken and is sold with the herring. The question of the possibility of canning it in oil has been considerably discussed. It would probably prove unprofitable, from the high price of labor and the uncertain supply of fish.

Of the California anchovy, Prof. Jordan writes:

This species is everywhere known as the anchovy. It reaches a length of about six inches. It ranges from British Columbia to Chile, and is probably found on the coast of Asia also. It is found in sheltered bays, and is everywhere extremely common, but rather more abundant south of San Francisco than northward. It serves as food for the larger species to a greater extent than any other single species, and, in fact, a majority of the larger fishes make a large percentage of their food of anchovy. At San Francisco it is occasionally brought into the market. Some attempts have been made to pickle them for the trade with spice, but this amounts to little as yet. They have no economic value.

In the proceedings of the National Museum, volume IV, 1881, Prof. Jordan writes of the *Anoplopoma fimbria*, or black cod:

From Monterey northward, generally common, especially in Puget Sound, when they are taken from the wharves. As a food-fish it is held in low esteem by the Chinese at Monterey, although sometimes fraudulently sold as Spanish mackerel. The large species taken in deep water about Vancouver Island, known to the Makah Indians as *beshow*, and by the whites as "black-cod," are highly valued as food-fish, according to Mr. Swan.

All the evidence that I have been able to collect from the reports of Prof. Jordan and other scientists, from fishermen and from my own observations, shows that the same species of fish, whether migratory or stationary, are richer in oil and other nutritious qualities the farther north they are taken. The black-cod, which is not considered worth eating at Monterey, is considered at Cape Flattery one of the most delicious food-fishes of the ocean, and at Queen Charlotte Islands, British Columbia, the natives procure from it great quantities of a peculiar fat, which, on cooling, becomes of the consistency of soft lard. This is used by the Indians instead of butter for eating, or is sold to other tribes for culinary purposes. The *Thaleichthys pacificus* (Richardson) or eulachon, sometimes called candlefish, when taken in the Columbia River, are not much fatter than a smelt, and are sold as smelts in the Portland markets, but when these fish are taken in Fraser River, British Columbia, they are rich with fat, and are considered most delicious eating, and at Victoria, British Columbia, are served up to epicures as a delicate pan fish. When taken still further north, at Nass River, British Columbia, near the Alaskan southern boundary, they are excessively fat and are taken by the Indians in immense quantities. The fat is extracted and sold as "small fish grease." Its component parts are nearly identical with the grease of the black-cod.

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*Fishery industries of the United States, Sec. 1, 1884, page 569.

The same remarks are applicable to the anchovy. When taken in Monterey or San Diego bays, it is only fit for bait; but in Puget Sound, which is its northern limit, it is in perfection, and is one of the fattest and most delicious flavored of the small fish, and is considered by experts to be far superior, in point of flavor and richness, to the best Mediterranean sardine. Some Norwegian and Russian fishermen here have put them up, in limited quantities, in vinegar and spice, and they are delicious and sell readily; but the men who attempted the enterprise were without capital, and there has been no one with executive ability to push the business forward to a success.

The anchovy come to Puget Sound in enormous quantities, and during their season, from May to November, every bay and inlet is crowded with them. When they first come from the ocean they appear in Clallam Bay, on Fuca Strait, then in Port Angeles, Dungeness and Sequin bays, then in Port Discovery, and next in Port Townsend and Scow bays, where their numbers are almost incredible. I have known them to be in such masses at Port Hadlock, at the head of Port Townsend Bay, that they could be dipped up with a common water bucket, but as there has been no demand for them the fishermen do not consider them of value, and when hauling their nets for smelt they generally let the anchovy escape. The anchovy differ from herring in one respect—the herring, when they visit the bays, keep inshore and are easily caught in seines and landed on the beach; anchovies, on the contrary, keep out in deep water and seldom approach the shore, so that drag seines are of no use to capture them. They can be best taken with purse seines, as mackerel are taken in the Atlantic. As these fish are small, not much over 6 or 7 inches in length, they require a net with a small mesh, and with suitable gear an enormous quantity can be secured.

The only person I have known who has tried the experiment of putting anchovies in oil, like the French sardines, is Mr. Joseph O. Cates, of Port Townsend, fish dealer. Mr. Cates formerly worked in the sardine canneries at Eastport, Me., and is an expert workman. He procured some tin sardine cans, and this summer put up a few dozen as an experiment and to show what he could do. Some were put up in California olive oil, and some in refined cotton-seed oil. The result proved a complete success, and demonstrated the fact that the anchovy of Puget Sound are equal in every respect to the best French sardines.

These fish were tested by experts, and were found to be delicious. It is difficult to perceive any difference between those put up in olive oil and those put up in cotton-seed oil. Capt. Z. L. Tanner, of the U. S. Fish Commission steamer *Albatross*, is of the opinion that for export purposes olive oil is preferable, as he informed me he had observed in the Eastport sardines that those put up in cotton-seed oil will, after awhile, acquire a peculiar taste which, although quite sweet, is not agreeable to every one, and is readily detected by experts; but as the so called sardines of Eastport are either young herring or the small fry of other species, the remark may not apply to the anchovy of Puget Sound, and time must be the only test. It is, however, conceded that these fish put up in pure California olive oil are equal to the best sardines the world can produce.

An opportunity is now presented to persons of capital and experience, for it requires both, to come here and start this industry on a scale which must insure success.

Port Townsend presents peculiar advantages. Not only do the anchovy swarm in the bay in their season, but in Scow Bay or Long Harbor, making up from Port

Townsend Bay, between the Marrowstone Islands, where, in those landlocked and sheltered waters smelts, herring, and anchovies abound. I have shown that in the waters of Puget Sound the anchovies are in their best condition, plump and very fat; and the failure of the experiments which Jordan says have been made to can these fish in oil at Monterey, San Diego, and San Francisco, where they are poor and of no commercial value, is no argument against the Puget Sound anchovy being put up in oil as sardines, as they are very fat and, as has been proved by the experiments of Mr. Cates, they are of superior quality and delicious flavor.

Should my remarks attract the attention of any persons desirous of engaging in the business of preparing sardines in oil, they should procure all their gear and machinery from the East. The purse seines, drag seines, and all fishing gear should be procured in Gloucester or Boston, Mass., and should be of the best quality and new. So also of the machinery for making the cans, soldering, etc. It should be of the latest and best designs, and procured of the best manufacturers. It is false economy to bring out second-hand or old-fashioned, discarded machinery. Everything should be the best approved in design and new.

Persons of experience in the sardine business know what would be the cost of a small plant, which could be increased as business demands, and they know what capital will be required; and this should be furnished entirely from the East. No one should come to Puget Sound expecting to secure capital, for it is not here; or bonuses, or donations, which, in the vernacular of the times, are "played out." The people of Puget Sound, and of Port Townsend in particular, have given away in bonuses, donations, and subsidies thousands of dollars for railroads, manufactories, and fisheries, which have produced no beneficial results. Those, therefore, who wish to engage in this lucrative business should do so entirely with eastern capital. Any one coming here with ample means to start the sardine business will find no difficulty in securing a suitable location on the most favorable and encouraging terms.

During the boom times adventurers, with small experience and with no capital but "cheek," came here to start fisheries, canneries, woolen mills, steel works, cement works, and other enterprises, relying upon subscriptions, donations, and subsidies for their capital, and every one proved a failure; and now those persons coming here without capital, seeking donations, are looked upon as frauds.

I have been thus plain in my statement because I know there is a means here for an immensely lucrative business in canning sardines in oil, which should attract the attention of eastern capital and experience. I do not advise inexperienced or impecunious persons to come here; we have plenty of such persons here already. But I do advise persons of means, and experience in the sardine business, to come here and examine into the truth of my statements, and I feel confident that I can convince them that I am correct.