

## NOTES ON THE SHRIMP AND PRAWN FISHERIES OF THE UNITED STATES.

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## 1. THE EDIBLE SPECIES OF SHRIMP AND PRAWNS.

At least six species of shrimp and prawns are used as food on the coasts of the United States. They are as follows: *Crangon vulgaris*, *Crangon franciscorum*, *Penaeus setiferus*, *Penaeus brasiliensis*, *Pandalus Danae*, and *Pandalus*, sp. *Crangon vulgaris* is common to the sea coasts of both sides of our continent; but the two species of *Penaeus* are confined to the Atlantic and Gulf coasts of the Southern States, and *Crangon franciscorum* and both species of *Pandalus* to the Pacific coast. Three other species of prawns—*Pandalus leptoceros*, *P. Montagu*, and *P. borealis*—occur in great abundance in the deeper waters, off the coasts of Middle and Northern New England, and the British Provinces, and, although not now fished for, are available as food. In addition to the above, there are two species of fresh-water or river shrimp, common to the Mississippi River and its tributaries, which occasionally find their way into some of the interior markets. They are *Palæmon Ohionis* Smith, and *Palæmonetes exilipes* Stimpson. The common little shore prawn of the eastern coast of the United States, *Palæmonetes vulgaris*, although extremely abundant, is too small to answer as an article of food for man. All of our shrimps and prawns are eagerly sought after as food by many of our coast fishes.

THE COMMON SHRIMP. *Crangon vulgaris*, Fabr.

*Crangon vulgaris* is one of the most widely distributed of all of the shrimps, occurring on both sides of the North Atlantic and on the Pacific coast of North America. Its bathymetrical range is also great, extending from low water to a depth of 60 or 70 fathoms. On the Atlantic coast of North America, it has been recorded from North Carolina to Labrador, and on the Pacific coast, from Point Conception to Alaska (Mutiny Bay). It is eaten in Europe as well as in this country.

"It is found in greatest abundance in shallow, and on sandy or weedy bottoms, but occurs also on muddy, shelly, and rocky bottoms." It varies much in coloration, imitating to a great extent the color of the bottom on which it lives. "It needs all its powers of concealment, for it is eagerly hunted and captured by nearly all the larger fishes which frequent the same waters. Fortunately it is a very prolific species, and is abundant along the entire coast, from North Carolina to Labrador, wherever sandy shores occur." [Verrill.]

The young swim free at the surface, for a considerable period after hatching. On the Southern New England coast, the eggs hatch during

May and June, but further south, as in Chesapeake Bay, the spawning season is somewhat earlier. This species attains a length of over two inches, exclusive of the feelers, but generally occurs much smaller than this. So far as we are aware, it is not captured for food south of New York, although it has been found in extreme abundance and of good size in Chesapeake Bay and elsewhere south, by the U. S. Fish Commission. In its favorite haunts it frequently occurs in vast numbers, and may be readily captured in marketable quantities.

On the California coast, according to Mr. W. N. Lockington, *Crangon vulgaris* occurs, associated with another species of the same genus (*Crangon franciscorum*), which excels it in size and generally in abundance. The average length of specimens there is said to be about 2½ inches; a length of over 3 inches is sometimes attained. It is distinguished from *Crangon franciscorum* in having a darker-colored tail and a larger proportion of black markings upon the body, as well as by the different form of the hand or larger claw. From its black coloring it has received among fishermen the name of black-tailed crab.

#### THE CALIFORNIA SHRIMP. *Crangon franciscorum*, Stimpson.

This species, according to Mr. Lockington, is the shrimp *par excellence* of the San Francisco markets, where it is sold during nearly every month of the year. It averages in length from 3 to 3½ inches. The characters by which it is distinguished from *Crangon vulgaris* have already been enumerated. Its range, so far as determined, is very limited, being from Puget Sound to Point Conception. In San Francisco and Tomales Bays it is very abundant, frequenting especially the sandy coves along the shores. It is fished for mainly by the Chinese, both for consumption in California and for shipment to China.

A third species of shrimp, *Hippolyte brevisrostris*, of a uniform light crimson or scarlet color, occurs in small quantities in San Francisco Bay, and is frequently captured along with the two species of *Crangon* and sold with them.

#### THE SOUTHERN SHRIMPS AND PRAWNS. *Penæus setiferus*, M.—Edwards; *Penæus brasiliensis*, Latr.

These two closely related species compose the bulk of the large supplies of shrimp or prawns consumed in New York and the southern coast cities. They frequently occur associated together in the same localities, and, being so nearly alike in appearance, are not distinguished apart by the fishermen and dealers. *Penæus setiferus* is supposed to be the more abundant species; it attains a length of 6 or more inches, exclusive of the feelers, and may measure more than three-fourths of an inch in depth and breadth, in the front or body part. Strangely enough these useful crustaceans are known both as shrimps and prawns to the fishermen who take them, as well as in the markets, the distinction

being made with reference to size only. According to Prof. Lewis R. Gibbes, of Charleston, S. C., the larger individuals of both species are termed prawns or sprawns, and the half-grown ones, shrimps. The prawns appear in shallow water generally in March, or, in very open springs, as early as the latter part of February, and remain in season for two or three months, after which the supply diminishes, and they retire for a time, apparently to spawn. Their spawning localities are not known, and Professor Gibbes adds, that he has never seen an individual carrying eggs. He suggests that they may ascend the rivers to spawn. In June and the succeeding months of summer, the half-grown individuals or "shrimps" are in season, and "for tenderness of flesh and delicacy of flavor are preferred to the prawns." In the autumn, they disappear from the coast and move into deeper water, or farther toward the south.

*Penæus brasiliensis* has been found as far north as the Croton River, at Sing Sing, N. Y., and from that point ranges southward along the entire Atlantic and Gulf coasts of the United States. It also extends to the coast of Brazil, and has been doubtfully identified from the California coast by Mr. Lockington. *Penæus setiferus* has not been recorded from northward of Norfolk, Va., but its southern range corresponds with that of the other species, at least so far as the coast of the United States is concerned. Neither of these species has been found in sufficient abundance north of North Carolina, however, to warrant a fishery for them.

Mr. T. E. Fisher, of Fernandina, Fla., who has had much experience in this fishery, furnishes the following notes on the shrimp and prawns of his region, which he distinguishes from one another, as Professor Gibbes has done above. "It is my opinion," he says, "that the shrimp (smaller individuals) move into deeper water at the beginning of winter, and there remain until about the full moon of March or thereabouts, when they return to the bays and rivers in great quantities, as prawns, and ascend the rivers and creeks, I think to spawn. This is the time when they are taken as food. After spawning, or about May or June, they return to the sea. From May to August the so-called shrimp, which then appear, are quite small, and used principally as fish bait. From August to December they grow quite rapidly. September and October are the best shrimping months of the year, and May and June are the only months when shrimp are scarce, excepting during the colder months of winter, when they leave the coast for a time." The shrimping seasons of the South Carolina and Florida coasts, therefore, correspond approximately, being somewhat longer for the latter region, probably because of its milder climate.

According to Mr. Silas Stearns, of Pensacola, Fla., shrimp are abundant on all parts of the Gulf coast, and especially so on the coasts of Louisiana and Texas. They live on the grassy and sandy flats, and among the weeds on the bottoms of bayous and lagoons, in both salt and brackish water. Baratavia Bay, of the Louisiana coast, and Galves-

ton and Matagorda Bays, of the Texas coast, are notable places for the shrimp fishery. Shrimp of marketable size average about four inches in length. The habit of schooling among shrimp is common, especially in the fall, upon the Louisiana and Texas coasts. The shrimping season extends through the year, excepting the winter months.

THE CALIFORNIA PRAWN. *Pandalus Danæ* Stimpson.

This is a moderately large species, which finds its way into the San Francisco markets from the open ocean, between the Farallone Islands and Point Reyes, where it is very abundant. It attains a length of five inches, exclusive of the feelers. Fresh specimens are finely marked with transverse zigzag lines of white, separated by bands of red. The known range of this species is from Queen Charlotte's Island, British Columbia, to Point Conception, California. It has been noticed with spawn in November, December, and January, but the entire length of the spawning season is unknown. This species has only recently been added to the market supplies of San Francisco, from the shrimp fishermen now venturing farther out to sea than formerly.

Another and smaller species of *Pandalus*, of a uniform light pink color, occurs associated with the above and is captured with it. Specimens of a species of *Penæus*, resembling *Penæus brasiliensis* of the east coast, are occasionally brought to the San Francisco markets and sold as prawns. They sometimes measure seven inches in length.

THE NEW ENGLAND DEEP-WATER PRAWNS. *Pandalus leptoceros*, *Montagui*, and *borealis*.

These are three closely related species of prawns, inhabiting the deeper waters of Massachusetts Bay, the Gulf of Maine, and other areas off the coasts of New England and the British Provinces. *Pandalus borealis* attains much the largest size, while the two other species are quite uniform in this respect, and only distinguishable from one another by a close examination. The only differences which the fisherman would observe are those of size, and he would, therefore, naturally recognize a larger and a smaller prawn, the former being *Pandalus borealis*, and the latter consisting of the other two species.

These three prawns have not yet found their way into the markets. They occur in very much the same kind of localities, are frequently associated together, but never approach near to the shore, and cannot be taken in the ordinary fishing nets and traps used upon our coast. They are known to the lobster fishermen of some part of the New England coast, from the fact of their occasionally entering the lobster pots in deep water. When their haunts, great abundance, and fine flavor, as well as the proper methods of capturing them, become known to the fishermen, it is fair to suppose that they will give rise to an important industry. Such a fishery must necessarily be more difficult than the shrimp and prawn fisheries of the Southern States, and would require

more capital, in the start, for the purchase of larger boats and more extensive nets; but there is every reason to believe that it would repay the outlay to, at least, a limited number of fishermen, for many important markets are close at hand.

These prawns are so readily recognized as such, in the regions to which they belong, that a description of their appearance is unnecessary here. We abstract the following notes, mainly bearing upon their distribution, from recently published observations of Prof. S. I. Smith.

*Pandalus borealis* attains a length of 7 inches. The body is thickly sprinkled with small red stellate spots, which, from closer aggregation, make the tail deeper in color than the rest of the body. The eggs are ultramarine blue. Females with spawn were taken in August and September, 1877 and 1878, in Massachusetts Bay and off Cape Ann. The following list of localities, from which this species has been recorded, will give an idea of its distribution: Massachusetts Bay, off Salem, 45 to 50 fathoms, very abundant on muddy bottoms; Gulf of Maine, 40 to 160 fathoms, muddy bottoms, very abundant in many places. In the Gulf of Maine, it was found to be especially common in a region about 14 miles southeast of Cape Ann, in depths of 50 to about 100 fathoms. It was also encountered 20 to 30 miles off Cape Sable, Nova Scotia, in depths of 59 to 88 fathoms, and 30 miles off Halifax, in 85 to 110 fathoms. In foreign waters, this species has been recorded from Greenland, Norway, and Behring Sea.

*Pandalus leptoceros* and *Montaqui* differ from *Pandalus borealis*, among other characters, in the coloration of the body, the red being more intense and arranged in clearly defined markings, of which those upon the carapax and abdomen form conspicuous, obliquely transverse lines or bars, while the color upon the rest of the body, and upon the appendages, is collected in distinct specks, blotches, or annulations. The length attained by these species is about four and a half inches, though the bulk of the specimens examined have measured somewhat less. Their range is from Eastern Long Island Sound to Greenland, in the West Atlantic, and from the British Islands northward, on the European coast. They are much more abundant than *Pandalus borealis*, though smaller in size, and occur in shallower water, as well as in the same places with the latter. South of Cape Cod, they are much less abundant than to the north of it, and average smaller in size; they occur in depths of 25 to 30 fathoms and deeper. In Massachusetts Bay, they inhabit depths of 22 to 48 fathoms, where the bottom is gravelly, sandy, and muddy, and have also been found on Stellwagen's Bank. In the Gulf of Maine, they are widespread and exceedingly abundant in many localities, being often associated with *Pandalus borealis* on muddy bottoms. They live on all kinds of bottom and in all depths of water, from 10 fathoms downward, having been found just to the eastward of George's Bank in a depth of 430 fathoms. In the Bay of Fundy, they occur in depths of 10 to 77 fathoms; off Nova Scotia, in depths of 16 to 75 fathoms; in Bed-

ford Basin, Halifax, in depths of 26 to 40 fathoms; in the Gulf of Saint Lawrence; on the coast of Labrador, &c.

The distribution of these three species of prawns, as above described, was mainly traced out by the United States Fish Commission, which, in its explorations with the dredge and trawl along the New England coast, during the past ten years, has constantly come upon immense schools of them, sometimes two or three of the species being associated together, at others occurring separately. It has been no uncommon occurrence for a peck or more to come up in a single haul of the beam-trawl, and several such hauls have been made in a single day. These prawns apparently swim in schools from place to place; they are active in their movements, and can, therefore, be seldom taken in the dredge. There are many witnesses among the members of the Fish Commission who can testify to the superior quality of the deep-water prawns as an article of food.

The lobster fishermen of Biddeford Pool, Maine, who set their pots in the winter from 4 to 6 miles from land, occasionally capture a few specimens, and the same is true of other localities. It is very difficult to suggest a proper style of apparatus for taking these prawns in quantity for food. The beam-trawl employed by the United States Fish Commission, which is a modification of the beam-trawl used by English fishermen, would probably answer as well as anything. The net used by the Chinese, on the California coast, for catching *Pandalus Danae* would, perhaps, answer the same purpose for the same genus, in moderate depths on our eastern coast; but the writer has no practical knowledge of its workings. It is possible, though not probable, that these prawns would seek bait in traps, constructed somewhat like the lobster pots, but with a finer mesh. The beam-trawl or some adaptation of it would, however, seem to approach nearest to the requirements of the case.

We do not wish it to be understood that we suggest the fitting out of boats and nets by the wholesale, for this proposed new fishery. Should any one become interested in it, he had best begin in a small way, and in the course of a season or two he could determine its practicability, and the additional outfit he might require.

THE RIVER SHRIMPS. *Palæmon Ohionis*, Smith, and *Palæmonetes exilipes*, Stimpson.

These are the only species of fresh-water shrimps so far described from the Mississippi River, its tributaries, and the rivers to the eastward of it, although others may sooner or later be brought to light. They do not appear to be used much as food, but the former species is occasionally taken for that purpose at some of the inland towns. At New Orleans the *Palæmon* is sold in the markets, and is probably canned in connection with the Gulf species. Both species have a considerable range, and have been recorded from over a wide area. *Palæmon Ohionis*

attains a length of at least three and one-fourth inches. *Palæmonetes exilipes* is a much smaller species, adult specimens measuring only about one and one-half inches long, and, on account of its small size, would probably never become an article of food.

THE COMMON PRAWN OF THE EASTERN UNITED STATES. *Palæmonetes vulgaris*, Stimpson.

This species of prawn approaches more closely in structure the English prawn than any other upon our coast; but, although it is very abundant and inhabits the shore region, its small size (about one and one-half inches) precludes its ever being used as food by man, at least to any extent. The English prawn measures in length from three to five inches. *Palæmonetes vulgaris* ranges from Massachusetts Bay to Northern Florida, and is most common among eel-grass. It also occurs in pools and ditches on the shore, even in brackish water, and on muddy and sandy bottoms in shallow water.

2. THE SHRIMP AND PRAWN FISHERY OF THE EASTERN COAST OF THE UNITED STATES.

THE NEW ENGLAND AND MIDDLE STATES.

None of the New England States can lay claim to a regular shrimp fishery, although a few shrimp are occasionally taken in various localities, mainly for use as bait. As already pointed out, the small species of prawn (*Palæmonetes vulgaris*), so common everywhere along this section of the coast, is too small to be put to any practical use, although it serves as an important article of food for some species of fish. From many inquiries regarding the true shrimp (*Crangon vulgaris*), it appears that this species is favorably regarded by amateur sportsmen as a bait for several of the game fishes, such as the sea-bass, &c. For this purpose it is taken in small quantities at Wareham, Mass., and along the eastern shore of Buzzard's Bay. Farther east than this it is also used to some extent by the same class of fishermen, and occasionally by small boys fishing from the wharves. About New Bedford, Mass., there is a small and irregular fishery, lasting from May to October, from one quart to four gallons being sometimes taken daily, though not for any length of time. The greater portion of this catch is used in the vicinity as bait, but a small quantity is sent as food to Providence and New York, the shipments, which are always small, being made in boxes, with a packing of seaweed, moss, or sawdust. In Narragansett Bay a few shrimp are taken nearly every season, for consumption in, and about, Newport. The largest daily catch brought to our notice was about one peck.

New York City uses a small amount of this species of shrimp every year, the supplies coming mainly from Bay Ridge, Long Island, and

the season lasting from March until the middle of May. The demand for this shrimp in Fulton Market appears to be increasing, and many more were sold there in the spring of 1882 than in the same season of 1880. In the latter year, Bay Ridge supplied New York with about 3,000 gallons of shrimp, valued at about \$1.50 per gallon. During July and August of every year, about 1,000 gallons of fresh shrimp are used in the vicinity of Bay Ridge, as bait for hook-and-line fishing.

The fishery for *Orangon vulgaris* is conducted mainly by means of dip or scoop nets. At Bay Ridge the nets are hauled every morning. Before being shipped to market the shrimp are boiled in brine and then dried. The average sales per day in New York during the season are about 50 gallons.

A very small quantity of shrimp are sent to New York from the New Jersey coast, where they are reported to be very abundant. They are also said to be extensively employed in the same region as bait for hook-and-line fishing, and for that purpose are regarded by many as superior to any other kind of bait. The shrimping season extends from May until about November.

#### THE SOUTHERN STATES.

The shrimp fishery has already attained considerable development in some sections of the Southern coast, but there is still ample material for greatly enlarging this industry. In Delaware a few shrimp are used as bait by the fishermen, but the yearly catch is comparatively small. Shrimp are very abundant on the Virginia coast, but, as in Delaware, they are taken only in small quantities for bait, or are captured incidentally in seines while hauling for fish. At Norfolk and Hampton they are occasionally eaten, and at the former place they are especially esteemed as bait for the "rock." The season extends through the spring, summer, and fall, but the shrimp are said to be most abundant in the latter part of the year. Prices vary greatly, and range from ten cents a quart, when very abundant, to twenty-five cents a dozen, in times of scarcity. The shrimp of Virginia probably includes both the *Orangon vulgaris* and one or both species of *Penwus*, but we have not been able to determine from observation which species is most utilized.

*North Carolina* appears to be the northernmost of the Southern States which offers especial inducements for shrimp-fishing, but no regular fishery has as yet been established there, except a small one at Wilmington. It can be safely asserted that the commercial shrimp of the Carolinas and succeeding Southern States consists of one or both of the species of *Penwus*. While the *Orangon* probably occurs there its small size, in comparison with the other species, renders it very inconspicuous to the fishermen.

Shrimp are very plentiful in Pamlico Sound; but in Croatan, Roanoke, and Albemarle Sounds they have never been observed in great abundance. They are also abundant about Beaufort and Morehead City. At



all of these places, where the shrimp occur in considerable numbers, they are frequently taken incidentally by the fishermen in their fish seines; but, finding no market for them, they are generally thrown away. The ordinary fish seines, on account of their coarse mesh, are not adapted to the shrimp fishery, and yet there are numerous accounts of large catches of shrimp, by this means, on the coast of North Carolina. The fishermen of New Berne, who work their large seines along the banks of the Neuse River, are said to often secure from 30 to 40 bushels of shrimp at a single haul; and again we hear of the capture of from 5 to 10 barrels at a time, by the fishermen of Beaufort. In addition to the fish seines being unsuited to the catching of shrimp, the fishermen also generally visit those shores which are less frequented by the shrimp, and might find them more abundant by looking for them elsewhere. According to all accounts, there seems to be every opportunity for the establishment of a successful shrimp fishery at several points on the North Carolina coast; but whoever engages in it must be provided with the proper nets and the means of preparing his catch for shipment. The fishermen of North Carolina complain that they have no market for shrimp, but New York city derives the most of its supplies from points still farther south, and that market is seldom, if ever, overstocked with shrimp. In the fall of 1879, a small shipment of fresh shrimp, packed in ice, was made to New York. The weather was warm and the shrimp spoiled on the way, but the receivers at Fulton Market state that they were of large size and fine appearance, and could have been readily sold had they been in good condition. The fault consisted in not boiling the shrimp in brine and then drying them before shipping, as is the rule elsewhere. The inhabitants along the coast of North Carolina do not appreciate the shrimp as food, and seldom eat them, and, therefore, nearly all that are taken are left on the beaches to decay. The New Berne marketmen have refused to buy them from the fishermen, even at the low rate of fifty cents a bushel, which must certainly have discouraged the latter parties.

The sounds and bays about Wilmington, N. C., abound in shrimp and prawns from the last of May until November. These crustaceans inhabit the brackish as well as the salt waters of this region. They are taken in shrimp seines, which were introduced at this locality in 1872, and also in skim and cast nets, which have been in use for a much longer period. The shrimp seines measure from 30 to 40 yards in length, and from 6 to 10 feet in depth, and have a half-inch mesh. In 1880, four seines, with eight seiners, were employed, while about 50 additional shrimpers used the skim and cast nets. The seines are owned in Wrightsville, or Middle Sound. The season's catch for each seine is about 500 bushels, making a total of 2,000 bushels for the four seines in use. The season's catch for the 50 additional shrimpers amounted to about 3,000 bushels. Not over one-half of this catch was marketed as food or bait, the larger specimens only being selected for these pur-

poses. The remainder were used for fertilizing, or were thrown away. Fishing is carried on in the daytime, but not with any precise regularity, on account of the limited demand. The shrimp are boiled in brine, in kettles holding from 10 to 50 quarts, and are then spread out to dry. They are shipped to market in baskets. Prior to 1878, no shrimp were shipped away from Wilmington, but since then a limited trade has sprung up with neighboring towns, and with New York and Philadelphia.

*South Carolina.*—One of the most important fisheries of the vicinity of Charleston is that for shrimp and prawns. From March to July, the larger prawns alone are taken, but later the smaller shrimp replace them entirely. The fishery continues from the last of March, or first of April, until the middle of November, and is carried on mainly within 15 miles of the city, and during the two or three hours of low tide of each night. The boats return to the city before daylight, so as to supply bait to the boat fishermen, after which the shrimp remaining are sold in small lots to men, women, and children, who vend them through the city. During the first of the season (1880), some 6 to 8 seine boats, with crews of about 6 men each, are engaged in this fishery. The catch is variable, being sometimes better in one locality and again in another; and often from 10 to 20 bushels may be the result of a night's seining by one or more boats, while the remainder will obtain only 4 or 5 bushels each. Prawns are considered to form one of the best baits for whiting, which are in season at the same time, and for this purpose the greater part of the catch is frequently sold. The shrimpers sell the prawns by the plateful, each containing from one to one and a half quarts, the customary price being about 50 cents per plate. The price sometimes rises to one dollar per plate, or at the rate of about two cents for each prawn. During the first few weeks of the prawn fishery, it is one of the most profitable of all of the fisheries in this section. Early in May the prawns become more abundant, and the seines are abandoned for cast-nets, the number of persons engaging in the fishery also increasing at the same time. During the height of the season, at least 75 cast-nets are in use, and, in June, the daily catch per boat exceeds one hundred plates.

The prawns are replaced by the shrimp early in July, and the latter continue near the shore until November. The difference in size between these two is roughly stated to be about as follows: that while only about forty prawns are required to fill a plate, a plateful of the shrimp will contain from fifty to sixty individuals. The number of shrimpers continues about the same as the prawn-catchers, in June, until near the close of the season; but the price soon falls to 25 cents, then to 15 cents, and finally to 10 cents per plate. The retail venders, who sell through the city, are all blacks, and begin their rounds early in the morning. As there are no city laws restricting their business, they compose a numerous body. Shrimp and prawns have come to be considered

a standard article of food in Charleston. The greater part of the catch is sold at home, only a few hundred bushels being shipped away annually.

*Georgia.*—The shrimp and prawn fishery of Georgia is of great extent and value, and during the height of the season gives employment to about 400 men. The season is the same as for the South Carolina coast. Many shrimp are sent every year from Savannah to the New York markets.

*Florida.*—Prawns appear in the shallow water about Fernandina, and elsewhere along the Florida coast, about the full moon in March, and enter the bays, rivers, and creeks in large numbers, as it is thought, to spawn. About May or June they are succeeded by the shrimp, which remain until December, or, if the winter be very mild, until the following spring. The best shrimping season is during September and October. The fishing grounds are on both muddy and sandy bottoms, in from 6 inches to 4 feet or more of water; and the fishing is done mainly during the night, when the shrimp or prawns are more abundant than in the daytime. Cast-nets only are used, as they are preferred to the seines. They measure from 10 to 15 feet in diameter. Two men go in each boat—one to row, the other to manage the net. The average daily catch per boat for the entire season would amount to about two bushels. Before shipping, the shrimp are washed clean, boiled about 10 minutes in a very thick brine, and then allowed to steam in a covered basket or barrel, after which they are spread out and dried on a platform of boards.

The shrimp fishery was well inaugurated at Fernandina several years prior to 1880; but for the want of patronage it did not succeed, and was, therefore, soon abandoned, not, however, from a lack of material, which is said to be exceedingly abundant and easy to obtain. Successful shipments have been made to New York, Philadelphia, and many Southern cities, but now the fishery is limited to supplying the home demand.

A small shrimp fishery is carried on at Saint Augustine, Fla., during the months of July, August, September, and October. The men use cast-nets, measuring from 4 to 5 feet long, and with a half-inch mesh, and make about three trips weekly, fishing at low tide during the night, or at early dawn. An average daily catch per boat is about 4 bushels. The entire season's catch, which in 1880 amounted to about 600 bushels, is used locally, either for food or bait. The price is about 10 cents per quart, in the beginning of the season, but at a later period it falls as low as 15 cents per peck.

*Gulf coast.*—The shrimp fishery of the Gulf coast is mainly confined to Louisiana and Texas, although shrimp may possibly occur in equal abundance in other sections. The greater part of the supplies come from Barataria Bay, Louisiana, and Matagorda and Galveston Bays, Texas. Both seines and cast-nets are used by the shrimpers, who station themselves along the shores in the shrimping region. The season extends,

more or less, throughout the entire year; but fishing appears to be conducted mainly from October to April. New Orleans is an important shrimp center, and derives the greater part of its salt-water supplies from the grassy bottoms of Barataria Bay. Three varieties of shrimp are recognized in the New Orleans markets: the Gulf shrimp, above referred to; the lake shrimp, found in the lakes and inclosed bays inside of the Gulf coast; and the river shrimp, from the banks of the Mississippi. The lake shrimp are obtained only during the equinoctial seasons; and the river shrimp, in small quantities, during the warmer half of the year. The latter species is caught by means of cane baskets, sunk to the bottom near the banks. Shipments are made to New Orleans from the coast in steamers or luggars, without ice. The prices paid to the fishermen on the Louisiana coast are about 3 cents per pound, and on the Texas coast about 25 cents per bucket. Fresh shrimp are very much esteemed as food in New Orleans, and large quantities are canned both in New Orleans and Galveston, for shipment throughout the United States and to Europe.

*Shrimp canning.*—In 1880, there were only two establishments in the United States for the canning of shrimp. One was located at New Orleans, the other at Galveston, and both were then doing a successful business; they did not, however, confine themselves entirely to the preparation of shrimp. The process of canning shrimp is similar to that for crabs and lobsters, as practiced at the North. The season includes about five months of the fall and winter. Over two hundred persons, mainly women and girls, are employed at this time. The shrimp are put up in one and one-half pound tins, the production for 1880 amounting to about 310,000 such cans.

### 3. THE SHRIMP AND PRAWN FISHERY OF THE PACIFIC COAST.

The shrimp and prawn fisheries of the Pacific coast are mainly confined to the vicinity of San Francisco and Tomales Bays, California, and are controlled almost entirely by the Chinese, who export the greater part of their catch to China. A small quantity is also shipped by them for the use of their countrymen in the Sandwich Islands. *Crangon franciscorum*, being the larger species of true shrimp, and also generally the more abundant one, figures most conspicuously in the fishery, but *Crangon vulgaris* forms a large percentage of the quantity taken and disposed of. These two species are fished for mainly in the deeper waters (12 to 20 fathoms), near shore, of the two bays above mentioned. The two species of *Pandalus* are found associated together in moderate depths of water off San Francisco Bay, between Point Reyes and the Farallone Islands, and during the two years prior to 1880 were more commonly seen in the San Francisco markets than formerly. The reason assigned for this fact was that as the supply of fish in the bay began to greatly diminish

about that time, the fishermen were driven to the more open waters of the ocean, where the prawns abounded:

A species of *Penæus*, closely resembling *Penæus brasiliensis* of the east coast, if not identical with it, has been recognized by Mr. Lockington in the markets of San Francisco, and is said by him to occasionally visit the bay of San Francisco. Being much larger than any of the other species of shrimps or prawns on the California coast, it commands a higher price; but some years it appears to be entirely absent.

For the capture of shrimp and prawns the Chinese use a conical, bag-shaped net, about 20 to 25 feet long and 10 feet across at the larger end, which is the mouth. From this end the net tapers toward the other, where there is an opening only about a foot across, to permit of emptying the contents of the net. One side of the mouth, or larger end, is furnished with a line of weights and the other with a line of floats, to hold it open while in use. The opening at the smaller end closes by means of a "sphincter," or puckering string. The mesh of the net measures from one to one and one-fourth inches at the mouth, and gradually diminishes to about one-fourth of an inch at the smaller end. The boats employed in working these bag seines are from 12 to 25 feet long, rather narrow and sharp at the ends, and with flat bottoms and thick, heavy sides. They are built by the Chinese, of redwood lumber.

After the day's fishing is over, it is the usual custom to carry the fresh shrimp to the Vallejo-street Market in San Francisco, in live-baskets, covered with a netting, which has a hole in the center, closed by means of a puckering string. At the market, the fresh shrimp are sold at the rate of about ten cents a pound, and those remaining unsold are carried back to the Chinese settlement and put at once into boiling brine. The kettle for boiling the shrimp is a rectangular iron tank, 6 feet long by 4 wide and 2 deep, with a fireplace underneath. After sufficient boiling, care being taken to prevent overcooking, the shrimps are taken out and spread to dry upon level plats of hard ground, which have been previously stripped of grass and rendered perfectly smooth. They are spread out, and turned occasionally, by means of a hoe-like broom. After four or five days' time, or when they are perfectly dry, they are crushed under large wooden pestles, or trod upon by the Chinese in wooden shoes, for the purpose of loosening the meats from the outer chitinous covering; after which the entire mixture is put through a fanning mill, for the actual separation of the meats from the shells.

This fanning mill, which is rather a crude affair, is constructed of wood, by the Chinese themselves, on the same principle as the one used for winnowing grain. The entire structure measures about 8 feet long by 5 high, and consists of a square box, divided in the inside for the passage through of the separated meats and shells, with a hopper above, and a large fan wheel, worked by a crank at one end.

The meats are partly consumed at home, or at the various inland Chinese settlements, but are mostly shipped to China. They are worth

5 cents a pound in San Francisco. The shells are utilized as manure, to some extent, about San Francisco; but, like the meats, are mostly sent to China, where they serve as a fertilizer for rice, the tea plant, &c. In San Francisco they sell at about 25 cents per hundred-weight. Both the meats and shells are shipped to China in sacks. The trade is entirely in the hands of Chinese merchants, who ship by way of Hong Kong. The meats are eaten by all classes, but are cheaper and less esteemed than the native shrimps, which are said to be comparatively scarce.

It is estimated that about 200,000 pounds of shrimps, valued at about \$20,000, are annually sold in the San Francisco markets. The total exports of shrimp meats and shells to China and the Sandwich Islands for 1880 were estimated by Mr. Lockington at above \$100,000. These are at present the most important food invertebrates of the Pacific coast of North America.

The greater part of the Chinese who engage in the shrimp fishery devote nearly all of their time to this industry. They live mainly in small, scattered colonies in San Francisco and Tomales Bays, and number several hundred in all. The more important colonies are at Bay View and along the shores of San Mateo, Santa Clara, Marin, and Contra Costa Counties.

There is no law regulating the shrimp fishery in California, and fishing is carried on more or less continuously throughout the year. It seems quite probable that the consumption of shrimps in the vicinity of San Francisco exceeds their rate of increase, and that a marked decrease in the supply will soon result, as has happened in the case of the food fishes in the bay of San Francisco. No such decrease has, however, been yet observed.

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#### SHAD IN PUGET SOUND.

By JAMES G. SWAN.

Mr. G. M. Haller, of Seattle, Wash., announces the taking by fishermen in a net of a shad, August 26, 1882, in Puget Sound. The Seattle papers also mention it and say that it was preserved by Mr. Levy for the Young Naturalists Society of Seattle. This specimen must have come from the Columbia River or have found its way north from San Francisco Bay. I think it was quite small—say 8 or 10 inches long—but I have not seen the dimensions accurately given.

PORT TOWNSEND, WASH., August 29, 1882.