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**DIVISION OF FISH AND GAME OF CALIFORNIA
FISH BULLETIN No. 27**

The Ring Net, Half Ring Net, or Purse Lampara in the Fisheries of California¹



DONALD H. FRY, Jr.

¹ Which name to use is a problem. "Purse lampara," although appropriate at the time the net was evolved, became less descriptive as it lost most of its lampara features. "Half ring," still the most popular term among the fishermen at San Pedro, originated from the practice of putting purse rings on only the middle half of the net. The name was appropriate for a while, but purse rings are now put around the entire net. The term "ring net" is by far the most suitable, and for the sake of clarity will be employed in this paper whenever the most recent type of net is discussed.



FIG. 1. Hauling a mackerel ring net. The purse rings can be seen bunched at the stern of the boat. July, 1929.

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FOREWORD

The purpose of this paper is to give a detailed account of a comparatively new type of net which has come into use in California. The work was directed by Mr. W. L. Scofield, in charge of the California State Fisheries Laboratory, and assistance was given by staff members of the laboratory. The material was obtained by direct observation and from the fishermen of San Pedro and Monterey. I wish particularly to thank Captain Ralph Barber and Captain Vincent Karmelich for their information and assistance, and Miss Annie Gillespie for her aid in making part of the diagrams. Photographs were taken by the author near San Pedro.

July, 1930.

1. INTRODUCTION

The ring net, or purse lampara, is a cross between the purse seine and the relatively light lampara. It first appeared at San Pedro, California, in 1918, and was pronounced a failure. A few persistent fishermen, however, insisted that it had great possibilities and continued to experiment. They finally succeeded in accomplishing their purpose, which was to combine satisfactorily the advantages of the two parent forms. In spite of its good points, the new net was not generally used until after 1926, when economic warfare with the sardine purse seiners forced the lampara fishermen to adopt a more effective form of gear. The use of the ring net has now spread to other fisheries, but its development is due entirely to California sardine canning. A brief history of this industry will show the reasons for the various changes in fishing gear.

2. HISTORY

2.1. The Ring Net in the Sardine Industry

The first sardine cannery on the Pacific coast was the Golden Gate Packing Company of San Francisco. It operated from 1889 to August, 1893, packing sardines in one- and two-pound round cans, and anchovies in quarter-pound cans. The fish were taken in San Francisco Bay with haul seines. The irregular appearance of the fish, together with other factors, led to the disbanding of the company and the sale of the machinery.

The next organization to enter the business was the California Fish Company,² established at San Pedro. This firm originally intended to can mackerel, but as the product was not a success it was soon decided to pack sardines as well. The management purchased the machinery of the Golden Gate Packing Company, and in December, 1893, began operations. Apparently from this time the mackerel canning dwindled away. At first the company canned sardines in earnest, but after they began packing tuna in 1906 the smaller fish were reduced to secondary importance, and finally, in 1909, were discontinued.

The sardines and mackerel were supplied by the first California purse seiner, appropriately named the *Alpha*, headed by Captain

² Several years later the firm changed its name to the Southern California Fish Company.

Young. A seine boat and a tender were used in connection with the *Alpha*. Two purse seines were carried. The smaller net, used for sardines, was 120 fathoms long by 8 deep. The webbing was at first 1 ½-inch mesh (stretched web) but as this size gilled too many fish, 1-inch mesh was soon substituted for it. The other net, used for mackerel, was 135 fathoms long by 17 deep and was constructed of 2-inch mesh webbing. The fish were carried in bins on the deck of the *Alpha*. The capacity was about 16 tons, but the loads were usually much less because the cannery specified the amount it would accept, which was customarily 3 or 4 tons. The pack was almost entirely of the small or quarter-oil sardines—the sizes that are put up in the traditional quarter-pound, key-opening sardine can. The cannery packed very little ahead of orders, and as Captain Young was instructed to get whatever size the latest order called for, there was a great deal of wasted effort.

The next cannery was established by F. E. Booth at Monterey in 1902, and has continued to pack sardines up to the present time. The sardines packed at Monterey were not the young "quarter-oils" but adult fish³ from 9 to 12 inches long. At first Booth believed that he could not find a sale for such large fish under the name *sardines*, so he labeled them *mackerel*. The Pure Food Commission insisted that this practice be discontinued, and Booth found he could sell his pack as *sardines*. For the first year the cannery operated on an experimental scale and was able to obtain enough fish from gill net fishermen. In 1903 the cannery moved into larger quarters and Booth felt the need of a better supply. To satisfy this need he decided to experiment with purse seining. The first Monterey purse seine was 200 by 12 fathoms, far larger than the one first used at San Pedro. The mesh size was the same, however—one-inch stretched web. The net and catch were carried in a "Sacramento River seine boat"—a light double-ended boat bearing some resemblance to a large dory. The boat and two skiffs were towed by a small launch. The seine was circled from the skiffs, pursed either from the skiffs or from the seine boat, and pulled up between the launch and seine boat. The two boats and the skiffs were all used to hold up the cork line while the catch was being dipped out of the net.

Because of its fine mesh and hand operation, the seine was of necessity pursed slowly. This, combined with the comparatively shallow depth of the net, made it almost impossible to catch the large sardines in deep water, as the fish would become alarmed and dive under the lead line. Adult sardines, such as Booth was canning, make more decided efforts to escape than the small or quarter-oil sizes. In shallow enough water the net proved quite effective. Sardines were not often found in shallow water in the daytime, however, except during a small part of the year, and the advantages of night fishing had not yet been discovered. Consequently, this purse seine provided a very erratic supply.

In casting about for a better method of taking fish, Booth learned from Pete Ferrante, the captain of his crew, that there was a net in use

³ On account of the custom of packing such fish in one-pound oval cans, they are referred to by the trade as "ovals."

in the Mediterranean called the "lampara," which was effective in deep water. This type of seine was laid in a circle around the fish and pulled into the boat from both ends. The two ends (wings) of the net were of coarse mesh so they could be pulled in easily. The central portion or bag was of fine mesh and was shaped like a scoop, the open end of which was pulled under the fish and then lifted out of the water. The design of the net was such that pulling in the wings first elongated the circle, and then brought the lead lines together under the fish. (Fig. 12.) The coarse mesh of the wings was intended to herd the fish into the scoop-like bag, from which they would be unable to dive to safety, as they so often did from the purse seine.

In 1905 Booth obtained one of these nets. It was old and went to pieces in a few hauls, but the fishermen made copies of it which proved decidedly more useful than their purse seine. It was soon found that the lampara was particularly efficient on dark nights, as the webbing excited phosphorescence when pulled through the water and made the wings exceedingly effective in herding the fish into the bag. In the daytime, on the other hand, sardines were quite likely to swim through the coarse mesh. Before long the purse seine became the standard gear for daylight fishing and the lampara for night fishing.

The launch and skiffs used with the first purse seine were also used with the first lamparas. The only great change was the substitution of an open lighter for the seine boat. As the lighter was used to carry nothing but the catch, the net was taken on the launch. The lamparas, like the original purse seine, were at first circled from the skiffs, but before long the fishermen learned to use the launch for circling both types of net. It was therefore unnecessary to use the skiffs while fishing, although one was still needed to help maneuver the lighter into position for unloading, and to moor the launch and lighter.

While the changes in gear were being made the sardine industry was growing at Monterey. Booth's plant was packing a great deal more than at first, and in 1906 a second cannery went into operation. This company was first known as the Monterey Fishing and Packing Company, but later (1908) as the Pacific Fish Company. As a result of the increasing demand, several new crews began sardine fishing. Almost all of them did their fishing at night with lamparas, although during the periods when there was moonlight from dusk till dawn some of the crews fished in the daylight with purse seines.

As the industry progressed, improvements were made in the fishing equipment. New lighters were larger and were decked over so they could be used in rough weather; larger and faster launches were built; and the lamparas were made longer, deeper, and of more efficient design. The effectiveness of the purse seine was greatly increased by the use of a power winch with which the net could be pursed. It closed the net so much more quickly that the fish could frequently be impounded before they became frightened and dove. As a result of this improvement, some fishermen came to prefer the purse seine for deep water fishing. Notwithstanding the simplicity of the winch, which was operated by the motor of the launch, there were some fishermen so conservative that they continued to purse by hand even though they used a purse seine exclusively. As late as 1914 there was one such crew.

of the two forms of gear, the lampara was by far the more popular. It had many advantages over the early purse seines. Because of the coarse mesh in the wings, it cost less to make, was less bulky, and could be pulled by a smaller crew in less time. The structure of the bag enabled it to fish deeper, and even after the adoption of power pursing, it was as sure of its catch in deep water. The absence of a purse line and rings made it less likely to foul on the bottom when fishing in shallow water. The one advantage of the purse seine was its superiority for daylight fishing. The advantages of the lampara offset this and resulted in more and more night fishing without a corresponding increase in daylight work. At Monterey in 1914 the 2 canneries employed a total of 8 crews. Seven fished for Booth, including 5 lampara outfits, 1 purse seine and 1 crew which used both but preferred the purse seine.⁴ The members of the Pacific Fish Company's crew (Japanese) used a purse seine part of the time, but preferred a highly modified lampara which they claimed was superior either to the purse seine or the true lampara. This net probably constituted one of the first steps in the development of the Japanese round haul net which later sprang into great prominence in southern California. In addition to the regular cannery crews, there were several small lampara outfits which fished for the fresh fish markets, for bait, and occasionally for the canneries. There were still some purse seines in use at Monterey in 1915, but by 1918 they had disappeared and the lampara had become the only sardine gear used in the state.

In 1916 war prices and the great demand for food products started a tremendous increase in the sardine business. New canneries were built at Monterey, and by 1917, 3 of them were packing—making a total of 5—and 2 more were nearing completion. In the southern part of the state no sardines had been canned for several years prior to 1915, but there were many tuna packers in operation. As tuna could be obtained only during the summer, the canneries were left idle during the winter months. In 1915 one San Diego outfit used its equipment to pack sardines during the winter and in the next two years 12 more tuna canneries followed suit. In addition to this there were 9 new canneries built in southern California during 1916 and 1917, and by the end of 1918 the number of packers in the state had increased to 37, as compared with 2 in 1914. The catch of sardines underwent a corresponding rise: 4,000,000 pounds in 1915 to 159,000,000 in 1918.

This sudden activity would not have been possible if there had not been a great increase in the number of sardine fishermen. At Monterey the crews increased from 8 in 1914 to about 32 in 1916 and 45 in 1919; then the post-war depression hit the sardine business and the number fell off to 25 in 1920. From that time on there has been a steady increase. In 1927 there were 57 *cannery* crews at Monterey. In the southern part of the state the number of crews was considerably larger. At San Pedro there were 88 sardine boats registered during the 1920–1921 season although probably there were a few more actually fishing. The number *fishing* in 1925–1926

⁴ This net, which was probably the largest sardine purse seine in use in the state at that time, was only 132 by 11 fathoms as compared with 200 by 12—the size of the first one used at Monterey. The shortening of the net was probably to decrease bulk and make faster pursing possible.

was 109, and 117 in 1928–1929. It will be noticed that the number of crews has increased more slowly at San Pedro. This is because the tendency there has been to increase the size rather than the number of sardine boats. The boats and lighters have increased in size at Monterey, but not nearly so rapidly. The smaller number of boats in use at Monterey is offset by the shorter distances and the longer fishing season. From 1917 up to the present time (1929) the annual landings have been about the same at the two ports. At San Diego neither the catch nor the number of boats has grown to nearly the same extent as at San Pedro and Monterey.

At Monterey the launches and lighters used for sardine fishing were built especially for the purpose; in the south not only the canneries but most of the boats were originally designed for use in the tuna industry. The albacore boats, in particular, proved especially adaptable to sardine fishing. The largest of these boats were able to carry a load of 25 to 30 tons of sardines on deck, and could make far better time than a Monterey launch and lighter combination. This was a great advantage, as the distances to be traveled were much greater in the south. Albacore boats soon became the standard for sardines at San Pedro and San Diego. They were used for their original work in the summer and for sardines in the winter. New boats were built along similar lines, but were made a little larger and more powerful than those already in use. There was no need for any radical change.

The sardine gear used in southern California, unlike the boats, was patterned after that in use at Monterey. In 1915, when sardine fishing was resumed in the south after the lay-off of several years, there was no adequate gear in that part of the state, so it was only natural that the lampara nets, which had proved so successful at Monterey, should be adopted by the southern California fishermen.

The Italian fishermen at San Pedro and San Diego built nets which were essentially the same as those in use at Monterey. The Japanese fishermen at San Pedro, on the other hand, modified the lampara by designing it to fish more deeply and simplifying the bag. Another Japanese modification used on some of the nets was a pair of so-called purse lines which consisted of two three-quarter-inch ropes, one fastened to the lead line at each end of the bag and tied to the wing about fifteen fathoms from the end. When the ends of these ropes were pulled on board, part of the crew hauled on them until the lead lines were pulled together. This method proved effective, especially at San Pedro, where much of the fishing is done in deep water.

In 1918 there was a further development when certain fishermen, instead of having the purse lines of their nets fastened directly to the lead lines, ran a rope through a series of purse rings around the lower edge of the bag. This was the first purse lampara or ring net. It is not certain whether this type of net was first used at Monterey or at San Pedro, as it was reported at both places about the same time. At Monterey it was soon given up, but at San Pedro its use continued. The first of these nets were not very efficient, as the pull of the purse line opened the coarse mesh of the wings and let the sardines escape, whereas the pull on the wings of a true lampara pulls the openings into elongated slits through which the fish do not often pass. Another disadvantage was that although the first purse lamparas did pull the bag

under the catch more rapidly, they kept the lead lines from coming together and left a large opening through which fish could escape. The net had purse rings on the bag only, and consequently it could not be completely closed like a purse seine, until the wings were hauled in. These difficulties were overcome in the course of the next several years by using somewhat finer mesh in the wings, changing the scooplake design of the bag, which did not purse properly, by enlarging the bag and adding purse rings to the wings so that more and more of the net could be pursed. The new net required some skill and experience to operate successfully, and this, combined with the natural conservatism of the fishermen, kept it from gaining rapidly in popularity until after the re-entry of the purse seiners into the sardine business in 1925. This will be discussed later.

As previously mentioned, the first purse seine fishing in southern California was done in 1893 by the *Alpha*. By 1898, 2 more purse seine boats had been built in that part of the state, but they did not fish there many years. After the Southern California Fish Company stopped canning sardines in 1909, there was no purse seining south of Monterey until 1914. During that year 2 purse seiners were built at Los Angeles. One of them left within a few months. During the next three years 8 others were added to the fleet. These boats and those built within the next few years fished for tuna, barracuda, white sea bass, yellowtail and mackerel, but with one exception⁵ they did not fish for sardines before 1925. They in no way resembled the sardine purse seine outfits at Monterey. The southern boats were much larger, carried their catch in the hold instead of in a lighter, and had sleeping accommodations for the crew of 8 to 12 men. The net of each boat was carried at the stern on a revolving platform or "turntable" about 15 feet square. At one edge of this turntable was a roller over which the seine was pulled. It was soon found that the engine could be used to turn the roller, which then became a great help in hauling the net. The pursing was done by a winch. The dimensions of a typical example of these boats are: length, 65 feet; beam, 15 feet; depth, 7 feet; net tonnage, 24; capacity, about 40 tons of fish in the hold and 25 or 30 tons more on deck.

The success of the increasing number of southern California purse seiners was so great that in 1918 a tremendous boom started. Boats came south from Seattle and new ones were built. In 1918 there were about 25 boats fishing and between two and three times that number in 1919. From \$1,000 to \$2,700 was made by *each fisherman* during the tuna season (May to September) of 1919 alone. Then, in 1920 the crash came. The post-war depression hit the fisheries industries hard. The demand for fishery products was greatly reduced, and in addition, there was apparently a temporary decrease in the available supply of tuna. The fleet had grown to over a hundred boats, but in spite of this, the *total* landings of tuna and yellowtail were far lower than in the previous year. The catch per boat was so low that most of the fishermen did not make expenses. In 1921 conditions were even worse, and as a result numbers of boats went to northern waters; of

⁵ The one exception was a purse seiner which did some sardine fishing for canneries at Newport and Long Beach (both near San Pedro) early in 1919 and again in 1921. Economic conditions, not difficulty in obtaining fish, forced the boat out of the sardine industry. A fishermen's strike put an end to operations in 1919 and in 1921 the cannery for which the boat was then fishing went out of business.

those that remained in the south many were tied up or were used as tenders.⁶ Most of the boats were mortgaged far above the amount for which they could be sold, and a great many of the fishermen not only lost their investment—the savings of a lifetime—but were several thousand dollars in debt. During the next two years this state of affairs continued, and almost all the purse seine boats became money losers. often the only question seemed to be whether a boat would lose money faster by fishing or by remaining idle.

These vessels ranged from 48 to 72 feet in length, but two-thirds of the number lay between 59 and 66 feet, inclusive. The carrying capacities of the majority probably lay between 50 and 70 tons of fish, deck-load included. The registration cards of the Bureau of Commercial Fisheries of the Division of Fish and Game of California, showed that 63 purse seine boats were registered in 1924 and were used during 1923 as follows:

31	purse seined during the entire year.	.
17	were tenders during the tuna season (about May–September) and were idle the rest of the year.	.
8	purse seined less than half the year and were idle the rest of the time.	.
3	fished as live bait boats, <i>i. e.</i> , used hook-and-line with live bait.	.
3	were registered as having been idle all year. ⁸	.
1	fished with trammel nets.	.

At the beginning of 1924 there were at least 63 purse seine boats in southern California, many of which were losing money, and there were highly trained crews desperately anxious to find some way of getting back part of their investment. By the end of the year the situation had improved somewhat and a few of the purse seine boats showed a profit. Nevertheless the demand in the fisheries where the purse seiners were working was still not great enough to keep all of them busy, especially during the winter season.

Since 1921 the sardine industry had been growing rapidly, and about this time someone evidently decided that money could reasonably be invested in a sardine purse seine. (A purse seine costs about \$5,000.) Early in January, 1925, purse seining for sardines was begun at San Pedro, and 2 boats operated during the remainder of that season. Their good fortune encouraged others, and before the end of the next season (1925–1926) there were 33 purse seine boats fishing sardines; 30 of these used purse seines, and 3 used round haul nets. It could not be ascertained whether the latter were ordinary lamparas or were pursed.

The success of the purse seiners at San Pedro was remarkable. These boats, with less than a season's experience in sardine fishing, were obtaining, with 1 or 2 hauls, loads of from 20 to 50 tons; while the lampara fishermen were commonly making 3 and 5 hauls for catches of from 10 to 25 tons, although under favorable conditions 2

⁶ "Tenders" take supplies to the fleets of tuna or albacore boats and return with their catches.

⁷ The use of purse seiners as live bait boats has since become exceedingly common. Many boats now fish for tuna in this way during the season, then remove the bait tank and use a purse seine during the rest of the year.

⁸ This figure may be lower than the actual number of idle purse seiners since a man is not required to register his boat unless it is actually being used in the fishing industry.

or more boats could load up from one haul. One reason for the excellent results of the purse seiners lay in the size of the nets. At Monterey in early years, one of the chief advantages of the lampara for deep water fishing was the depth at which it would fish. This advantage was almost entirely eliminated by the introduction of power pursing, which enabled the purse seiners to close their nets and trap the fish in much less time than could be done with a lampara. The lamparas did fish deeper—but the fish had more time to escape. In southern California the use of the turntable and power roller made it practicable for the purse seiners to handle larger nets than had ever been used at Monterey. A large seine at Monterey in 1914 measured 132 by 11 fathoms, whereas most of the nets in use at San Pedro in 1925 were from 200 to 220 fathoms long and from 20 to 25 fathoms deep. The purse seines fished almost as deep as the largest of the Japanese round haul nets, would close in less time, and contained no coarse mesh through which the fish might escape. In addition to the superiority of their nets, the purse seine fishermen had other advantages. A purse seine boat could carry on the average almost twice as much as a lampara outfit, was a little faster, and could be used in considerably rougher weather. These factors, together with the sleeping quarters on board the purse seiners, enabled them to extend the fishing grounds to include the Santa Barbara Channel Islands, and thus utilize several times the former fishing area.

The lampara fishermen, seeing their business being taken away from them, began to do what they could to offset the advantages enjoyed by the purse seiners. Obviously the disadvantages which were inherent in their boats could be remedied only by the purchase of boats of the purse seine type. Some of the men did buy new boats, but most of them were either unable to raise the money (about \$20,000 at that time) or did not wish to risk such a sum. The next best thing was to improve their fishing gear. The purse seines had proved to be much more effective, but they, with their turntables, were too bulky to carry on a lampara boat. The pursing feature, however, with its quick and positive closing, could be had with little added bulk in that neglected compromise between the purse seine and the lampara known as the ring net.

The ring net, although it originated in 1918, was used very little before 1926. The lampara fishermen had seen no need to experiment, as the gear they were using seemed entirely satisfactory. At the end of the 1925–1926 sardine season, ring nets were a rarity, but within two years they had replaced the sardine lamparas almost completely. By the end of 1928 the regular sardine fishermen at San Pedro had entirely abandoned the lampara. Its only users, besides the live bait outfits, were a few small mackerel and fresh fish market boats, many of which have since adopted the ring net. The live bait fishermen have all continued to use the lampara, as an exceedingly light net is entirely adequate for their needs.

After the adoption of the ring net, the competition between the two classes of *boats* continued to be quite one-sided, although not as much as before. The rivalry between the forms of *gear*, on the other hand, was much keener. The purse seine, having no coarse mesh, was surer of its catch, once the fish were circled, and being of heavier construction

could make larger hauls without danger of tearing. As the ring net, on the other hand, was less bulky, it could be made deeper and could be hauled in less time. This feature of rapidity in hauling proved a very great advantage when the fish were running in small schools or were exceedingly "wild," so that many hauls were required to obtain a load. The advantage of the ring net which had the most immediate appeal to the fishermen, however, was its relatively low cost. A purse seine cost about \$5,000 and lasted one to two seasons, while a ring net cost less than half that much and lasted two or three seasons. As a result of its various advantages, purse seine boats began using the ring net. They removed their turntables and in many cases built a low platform on to which the net was hauled. The nets they used were similar in design to those of the smaller boats, but were usually heavier and made with somewhat larger bags.

During the 1928–1929 sardine season there were 21 boats of purse seine size using ring nets. The majority were purse seine boats which had removed their turntables, but a few were live bait boats which had taken advantage of the opportunity to enter the sardine fishery without the expense of purchasing purse seines and turntables. Before the opening of the 1929–1930 season, the captains of some of the larger boats had come to the conclusion that the comparatively light ring net was too easily torn by a heavy boat in rough weather, and returned to the use of the purse seine. A few of the largest boats, on the other hand, merely put heavier twine in the nets and continued to fish with the ring net. Several smaller boats of the purse seine type had adopted the new net, however, so the final total of boats of purse seine size was the same in the 1929–1930 season as in the year previous. The boats using ring nets seemed to have been a little more successful than the purse seiners during the period over which detailed observations were made (the first two months of the 1929–1930 season). (See pages 55 to 59.)

The history of the ring net at Monterey is very much the same as at San Pedro, except that the ring nets were adopted later in the north. Up to the 1929–1930 season at Monterey the fishermen's unions were able to keep purse seiners away by threatening to strike if the canneries accepted fish from such boats. Two purse seine boats belonging to the K. Hovden Company were allowed to continue as they had already begun fishing before the ultimatum was delivered. Then shortly before the opening of the 1929–1930 season, the lampara men finally lost their hold on the situation, and there was a great rush of purse seiners to Monterey waters. The purse seiners were so much more successful that the lampara crews soon followed the lead of southern fishermen and turned to the ring net. At the opening of the season there were two ring nets being used by former lampara boats. During the first interruption in fishing caused by full moon a few more lampara outfits adopted ring nets. Many others followed suit during the second full moon of the season. By the end of the third full moon interval all but three or four were using the new gear and even these conservatives had made the change before the end of the season. At Monterey the chief argument for the adoption of the ring net was its greater ease of operation. Crews which had formerly needed as many as eight or ten hauls were now getting a load with one to three hauls. In addition, pursing

of a net made the hauling much easier, as part of the work was done by machinery. As a result of this lightened labor, the captains who continued to use lamparas found their best men deserting to the ring net crews.

The canneries at San Diego are primarily interested in tuna, and the sardine fishery is a decidedly casual one. Almost all the sardine boats are small and there had been no competition of a type to make the fishermen worry about improving their gear. Until 1930 all the small boats used lamparas, then two obtained ring nets. One of them had not been unusually successful with a lampara, but with the new gear it "showed up" the rest of the fleet. The other ring net outfit was not greatly interested in sardines and caught them only incidentally.

The one cannery which packs sardines in the San Francisco district is that of the F. E. Booth Company at Pittsburg. Like the San Diego plants this firm is supplied by lampara fishermen. The similarity ends there. The northern firm does not regard sardines as of secondary importance, and the fishery is anything but casual. During 1928 the sardine catch received by this one cannery was nearly four times as large as that of the six San Diego packers combined, and in 1929 it was over ten times as great. At San Francisco there is (1929–1930) a fleet of eight sardine boats each on a thirty-ton limit. Fish are abundant and none of the boats have had any trouble in obtaining the limit regularly with a lampara, so there has been no reason to change gear. One outfit did use a ring net for a short period, but abandoned it without a thorough trial since there seemed to be little or nothing to be gained by the change.

To summarize the history of the gear used in the California sardine industry: The first net used, once the fishery had passed the experimental stage, was a purse seine entirely hand-operated. The lampara, because of its greater speed, deeper fishing, lighter weight and lower cost, became very much more popular than the purse seine and finally supplanted it entirely. A mechanically operated purse seine was perfected in other fisheries and introduced into the sardine fishery. This purse seine, with its more positive action, threatened to put the lampara fishermen out of business, so they adopted the ring net, which combined many of the advantages of both the lampara and the purse seine. Except at San Francisco and San Diego, the ring net and the purse seine have become the only cannery sardine gear in use in the state. The lampara, because of its low price and simplicity of operation, remains the favorite when comparatively small quantities of fish are to be handled.

2.2. The Ring Net in the Mackerel Industry at San Pedro

In former years the mackerel fishery of California was primarily a hook-and-line one. The fish were sold at the fresh fish markets and as a rule no net fish were accepted, because the rough handling impairs the keeping qualities. Keeping qualities, however, are not so important to the canners, who nearly always pack the catch within a few hours of its arrival. In 1928, canning operations at San Pedro, and to a much less extent, at San Diego, created a demand for a great deal more mackerel than the hook-and-line boats could supply. As a result, many of the boats which had been fishing sardines for the canneries began fishing

mackerel. The smaller sardine boats, former lampara outfits, proved to be best fitted for this work, and many boats which were too small to fish sardines profitably were successful in the new industry. A few small boats tried to use lamparas for mackerel fishing, but most, if not all, have since adopted the ring net. At first the fishermen used their sardine ring nets for mackerel, but later built special nets with smaller bags and coarser mesh. These mackerel nets could be hauled in less time than those used for sardines. Time is an important factor in mackerel fishing, as the fish run in small schools and many hauls must be made to obtain a load.

Purse seiners in general are not successful at mackerel fishing as their nets take too long to haul. Furthermore, large boats are placed at a disadvantage by the canneries, which usually set a limit of from four to ten tons, and although they frequently disregard the limit for a large boat, they can not be counted on to do so. Hook-and-line fishing is the source of only a small part of the cannery catch, but is still the method by which most of the market fish are taken.

2.3. The Ring Net in Other Fisheries

Ring nets are used in the taking of barracuda, other market fish and tuna, but not on a large scale.

2.4. Changing Gear With the Seasons

For tuna the purse seine is by far the best net, while for sardine fishing the ring net has some distinct benefits. Appreciating this, several boats have been using tuna purse seines in the summer and sardine ring nets in the winter.

3. STRUCTURE OF RING NETS⁹

Although there is great variation in the details of ring nets, not only in different fisheries but in each individual fishery, nevertheless there has evolved a certain basic design. The structure of the ring net has many features of the purse seine and of the lampara. All three are kept on the surface of the water by a similar cork line strung with cork floats, and are hung vertically in the water by a heavily weighted lead line. The ring net, like the purse seine, has purse rings along its lower edge. Some of the chief structural differences between the ring net and the purse seine are that the purse seine is made of comparatively heavy tarred webbing, is practically uniform throughout its entire length, and is practically square on the ends; while the ring net, like the lampara, is made of light tanned webbing, is gathered on the ends, and is made in three parts: a central "bag" of fine webbing and two end portions or "wings" of coarse mesh. (Fig. 2.) The relative lengths of bag and wings vary greatly. The bag may be from one-fourth to almost the entire length of the net.

The only way in which these widely different seines can satisfactorily be described is as though they were new. of the ring nets now in use, not many were ever entirely new. When a fisherman builds a net, he uses any material he happens to have on hand, and buys only what is

⁹ Full descriptions of the structure and operation of lamparas can be found in the report by Higgins and Holmes (1921), and in Scofield's paper (1929, pp. 25-44).

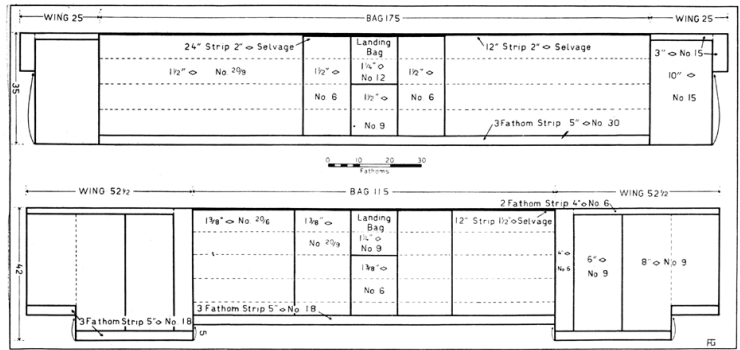


FIG. 2. Diagrams of two San Pedro sardine ring nets used during the 1929-1930 season. The upper is a heavy net 225 fathoms long, of the type used on some purse seine boats. The lower is a lighter net 220 fathoms long, such as is commonly used on small purse seine and large Japanese ring net boats. The net represented is somewhat deeper than the average. The depth commonly referred to is that of the bag—even though the wing is deeper. Diamond is symbol for mesh. Dimensions are in fathoms. Dotted lines separate strips of like webbing; solid lines separate unlike webbing. Curved arrows show take-up. Nets are gathered at each end.

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absolutely necessary. After the net has been in use for a while some of the webbing gives way and a patch is put in. By the end of a season or two the net is a veritable crazy quilt. Finally, let us say, the bag tears so often that it is necessary to replace it entirely, but the wings are still in fair condition—and so on. Since the nets used for the taking of different kinds of fish show decided variation, the ring nets as used in different fisheries must be discussed separately.

3.1. Sardine Ring Nets

The ring nets used for sardine fishing at San Pedro range from 100 to 300 fathoms¹⁰ in length and from 20 to 50 fathoms in depth. The

TABLE 1
Sardine Ring Net Sizes, San Pedro, 1929

Depth, fathoms	Length of sardine ring nets in fathoms									
	100	125	150	175	200	225	250	275	300	Total
15.....										
20.....					1	1				2
25.....		1	2	2	1		2			8
30.....	1				5	2	1		1	10
35.....		1		2	2		3		1	9
40.....			1			3			1	5
45.....										
50.....					1					1
Totals.....	1	2	3	4	10	6	6	0	3	35

TABLE 1
Sardine Ring Net Sizes, San Pedro, 1929

TABLE 2
Sardine Purse Seine Sizes, San Pedro, 1929

Depth, fathoms	Length of sardine purse seines in fathoms						Total
	150	175	200	225	250	275	
15.....	1						1
20.....	2	6	8	1	1		18
25.....		2	10	4	2		18
30.....			1	1		1	3
35.....					1		1
Totals.....	3	8	19	6	4	1	41

TABLE 2
Sardine Purse Seine Sizes, San Pedro, 1929

¹⁰ The fathom as used by fishermen is not always an exact measurement. Many, perhaps most, use a 6-foot rod, the others measure with their extended arms and hold the rope or webbing with varying amounts of slack. By the latter method Caucasian fishermen measure "fathoms" about 6 feet long, but the Japanese are much smaller and many of them can not reach over 5 feet. As a result a Japanese "fathom" may be anywhere from 5 to 6 feet. Where measurements of an individual net are given the figures are always in 6-foot fathoms. When mass figures were gathered, it was impossible to find what length of fathom was employed in each case, so the figures were left unchanged. As an experiment it was assumed that the average Japanese "fathom" was 5 ½ feet and the figures were corrected on that basis. The resulting changes were of little importance and as there was no way of checking the accuracy of the method, it was abandoned.

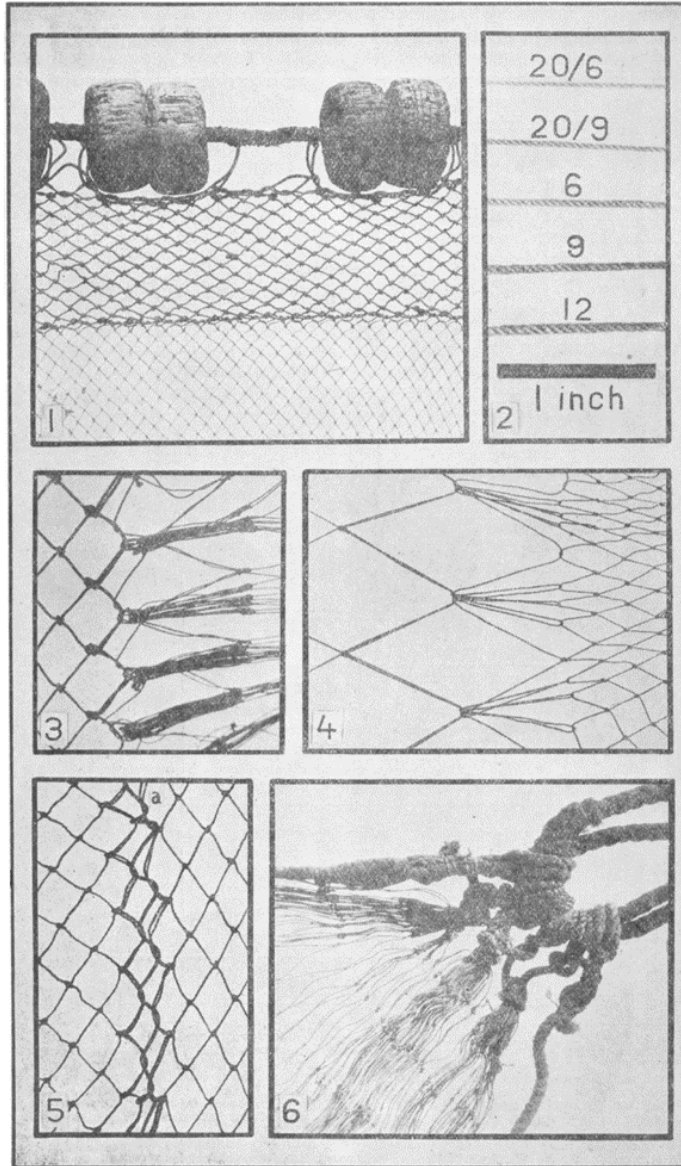


FIG. 3

FIG. 3

1. Cork Line of Ring Net Bag: This photograph shows the way in which a strip of heavy selvage is put between the cork line and the light webbing. The selvage is fastened to the cork line at points several inches apart, and the resulting uneven strain would tear light webbing. The corks are 5 inches in diameter, the selvage is $1\frac{1}{2}$ -inch mesh No. 36, and the light webbing is $1\frac{1}{4}$ -inch mesh No. 20/6. Mesh size, stretched web, is the length of a mesh when the webbing has been pulled so that the meshes are mere slits; i.e., it is twice the distance between knots.

2. Twine in Ring Nets (actual size): Parts of nets in which the different sizes of twine are customarily used:

20/6 Bags of sardine nets.

20/9 Bags of sardine nets near the landing sack.

6 Wings of sardine and mackerel nets (4-inch mesh).

Bags of mackerel nets.

Reinforcing next to the landing sacks of sardine nets.

9 Wings of sardine and mackerel nets (6- and 8-inch mesh).

Landing sacks of sardine and mackerel nets.

Reinforcing under the landing sacks of heavy mackerel nets.

12 Landing sacks of mackerel nets and of heavy sardine nets. 15 (not shown) is also used for these purposes.

Heavier twine is chiefly used in tuna nets and as selvage.

3. Gathering at End of Wing: The webbing of the wing is gathered up and laced to a small piece of heavy webbing. Eight-inch mesh No. 9 and 3-inch mesh about No. 42.

4. Junction of Wing and Bag of Mackerel Net. (This is an unusually neat piece of work): The 2 sizes of webbing are 8-inch mesh No. 9 and 2-inch mesh No. 6.

5. Take-up: One mesh at *a* is laced to 2 meshes of the other piece of webbing. The process is repeated 4 meshes lower down.

6. Brail End: The lead line, cork line and webbing are all fastened to a loop of heavy rope. The loop can quickly be fastened to a haul line or skiff.

majority of the regular sardine fishermen use nets from 150 to 250 fathoms long and from 25 to 40 fathoms deep. Table 1 gives the length and depth of the ring nets used during the 1928–1929 sardine season; table 2 gives the same data for purse seines. The figures were obtained from the boat registration files of the Bureau of Commercial Fisheries. All the boats which fished are *not* included. Data concerning the gear used in one season can not be obtained until the boat registers for the next season. Some boats went out of business, left the district, or for some reason neglected to reregister. Others did register, but gave incomplete data about their gear. Notice that the purse seines are about the same length as the ring nets but are on the average more than 8 fathoms shallower. The purse seines, because of their bulkier construction, are not made as deep as the ring nets. The extra depth is a great advantage when the fish are far below the surface. Notice that the purse seines adhere much more closely to a definite shape than do the ring nets, *i. e.*, sardine purse seines show a much more decided correlation between length and depth than the ring nets.

TABLE 3
Relation of Ring Net Size to Boat Size, San Pedro, 1929

Total capacity of boat in tons	Total length of net in fathoms								
	100	125	150	175	200	225	250	275	300
120 and over.....					2				1
100-119.....					1	1			
80-99.....			1		1				
60-79.....					1	1	3		1
40-59.....	1	1	1	4	2	1	1		1
20-39.....					3	1	1		
0-19.....		1	1			1			

TABLE 3
Relation of Ring Net Size to Boat Size, San Pedro, 1929

TABLE 4
Relation Eetween Size of Ring Net Bag and Size of Boat, San Pedro, 1929

Total capacity of boat in tons	Length of bag in fathoms					
	60-79	80-99	100-119	120-139	140-159	160-179
120 and over.....				1	1	
100-119.....						1
80-99.....					1	1
60-79.....			2	4	1	1
40-59.....	1	1				
20-39.....	1		2			
0-19.....		1				

TABLE 4
Relation Eetween Size of Ring Net Bag and Size of Boat, San Pedro, 1929

The relation between size of boat and size of net is not marked. The length of the nets used on boats of various sizes is given in table 3. The correlation between the two as calculated from this table is +.26.

The reason for this low figure is that nets from 180 to 250 fathoms have proved to be the most satisfactory. On some of the larger boats, the bags alone are nearly this long and the wings are exceedingly short. Smaller boats which could not efficiently handle such a net use much shorter bags and longer wings. This change in proportion gives them about the same length of net with far less bulk. Thus it will be seen that the length of bag is much more closely correlated with the size of boat than is the total length of the net. ^(Table 4.) The correlation in this case is +.68.



FIG. 4. Unloading a sardine ring net for tanning and mending. All of one wing and about 6 feet of the bag have been pulled off the boat. Notice the 4-ounce leads, the purse rings and the coils of purse line. Part of a deck-load of sardines can be seen in the lower right corner. This boat was formerly a purse seiner. Notice the low platform built on to the stern to take the place of the turntable. Follow the railing of the boat to the forward edge of the purse line bins and the structure of the platform becomes evident. May, 1929.

FIG. 4. Unloading a sardine ring net for tanning and mending. All of one wing and about 6 feet of the bag have been pulled off the boat. Notice the 4-ounce leads, the purse rings and the coils of purse line. Part of a deck-load of sardines can be seen in the lower right corner. This boat was formerly a purse seiner. Notice the low platform built on to the stern to take the place of the turntable. Follow the railing of the boat to the forward edge of the purse line bins and the structure of the platform becomes evident. May, 1929

The cork line of a sardine bag is strung with corks 5 and 6 inches in diameter and about 3 inches long. These corks are generally in bunches of 2 to 4, with spaces between bunches to give hand-holds. On most nets there are from 2 to 4 corks every 18 inches. The center of the net is usually more heavily corked, since the fish are finally concentrated there. Next to the cork line there is always a strip of from 6 to 24 inches of selvage. This is exceedingly heavy webbing, usually from 1½- to 2½-inch mesh about 36 thread. The cords of the selvage are so heavy that there is no more possibility of a fish getting through

2-inch mesh of this sort than through 1½-inch mesh light webbing. The selvage is laced to the cork line. Due to the large size of the corks and the practice of bunching them, the selvage can be fastened to the line only at intervals of several inches. (Fig. 3, pt. 1.) The weight of the net, of course, puts a tremendous strain on the parts fastened in this way, and it is for this reason that such heavy webbing must be used. When the strain reaches the light webbing underneath, it has been spread over several inches and made practically uniform. Another practice, seldom used, is to substitute a single heavy cord for the selvage. The webbing is laced to the cord, which in turn is fastened to the cork line.

The lead line is usually strung with egg-shaped 4-ounce sinkers. As a rule, they average 4 to 6 inches apart, although in the center of the bag they may be as close together as 3 inches. The purse rings are fastened to the lead line by means of pieces of three-eighths-inch rope, known as "bridle lines." The rings are of galvanized iron and are from 4 to 6 inches in diameter. They are fastened to the middle of the bridle lines; these are 12 to 15 feet long, and have their ends lashed to the lead lines at points about 10 to 13 feet apart. (Fig. 4) The rings are usually separated by from 2½ to 4 fathoms. Pulling on the purse rings gathers the lead line and webbing together and puts great strain on the webbing at the points where the ends of the bridle lines are attached. For this reason a strip of heavy webbing from 4 feet to 4 fathoms wide is placed between the lead line and the light mesh, much as the selvage is attached next to the cork line. This lower strip is usually of 5-inch mesh and is of from 15- to 30-thread twine. (Figs. 2 and 6.)

The webbing other than selvage used in the bag of a sardine ring net, is from ¾- to 1#-inch mesh. In past seasons, 1-inch webbing was quite popular, but as the size of the bags increased, so did the labor of hauling. The fishermen found coarser webbing easier to haul, and somewhat more effective because of the additional speed with which it could be pulled in. During the 1928–1929 season, 1¼-inch was the most common size. Since that time 1½-inch mesh has been gaining in popularity. Only the large or pound-oval sardines are now packed at San Pedro and Monterey; comparatively few such fish gill in 1½-inch webbing.

The largest part of the bag is constructed of 6- or 9-thread cable-laid¹¹ webbing. (Fig. 3, pt. 2.) On the upper edge of the bag at the center is a piece of 9- to 15-thread medium hard-laid webbing, which is known as the landing bag or brailing piece. It is from this that the fish are brailed into the boat. The brailing piece may be as small as 10 fathoms square, or as large as 20 by 16. Most of them are 14 to 16 fathoms square. (Figs. 2 and 6.)

There is almost always a piece of lighter medium hard-laid webbing directly under the landing bag, and often there are strips of No. 6 on each side of it as well. These pieces all serve to give added strength and to reduce the danger of tearing when the fish are being concentrated. A few fishermen place a strip up to about 8 fathoms wide of No. 6 along the entire lower edge of the bag between the cable-laid webbing and the 5-inch mesh selvage. (Fig. 8.) This serves as additional

¹¹ Cable-laid webbing is exceedingly light, being less than half the weight of hard-laid material of the same number of threads. Cable-laid is denoted by the symbol 20/, thus 20/6 would be 6-thread cable-laid. Hard and medium hard-laid webbing are of about the same strength. Hard-laid twine lasts a bit longer, but tends to kink annoyingly. Most of the fishermen at San Pedro prefer the medium hard. Both are designated by the number of threads: No. 6 means 6-thread hard or medium hard, etc.

selvage and reduces the danger of tearing when the net is being pursed rapidly. The practice is rare at San Pedro but is more common at Monterey.

Practically all large nets are made of strips of webbing sewed together. As a rule these strips are joined so that the knots point in the direction of greatest strain and are thus kept pulled tight. Pulling across the knots tends to loosen them and is likely to cause tears. In machine-tied webbing, the knots point *across* the strips, so the strips should be set at right angles to the direction of pull. The knot most commonly used, the sheet bend, is shown in figure 5 in the position which it occupies in a strip of webbing. To keep this knot pulled tight the greatest strain should be across the strip. In some Japanese-made netting the square knot is used. The square knot works loose much more easily when pulled in the wrong direction, and as a result webbing in which it is used is far inferior to that made with the sheet bend.

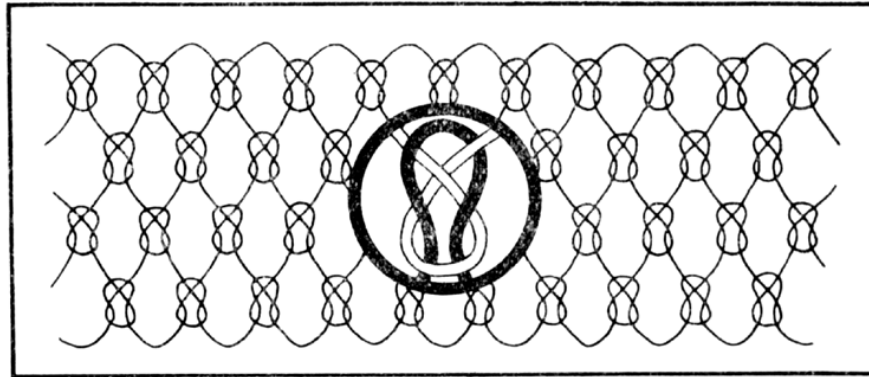


FIG. 5. Diagram of a narrow strip of webbing showing the position of the knots. Pulling along the *strip* tends to loosen the knots, while pulling across tightens them. Insert shows one knot in detail.

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The strips in sardine bags are usually from 300 to 600 meshes wide. After tanning, 600 meshes of 1-inch mesh or 400 of 1½-inch measure about 8 fathoms. The landing sack of the ring net and the webbing directly beneath it are invariably of horizontal strips. The remainder of the bag may be of either horizontal or vertical bands. As a rule those bags which are constructed largely of vertical strips have horizontal ones several fathoms long on each side of the landing sack. The reason for this structure is that when fish are concentrated near the landing sack, the ends of the bag and the lead line are on board; further concentration must be done by pulling in the lower part of the webbing and crowding the fish toward the cork line. When there is a large catch, this puts a great strain on the webbing and that strain is largely vertical. Consequently, horizontal strips of webbing must be laid in the center of the net. The ends of the bag are pulled horizontally by the crew and vertically by the purse line; consequently, it is not vital whether the webbing is laid horizontally or vertically. Both systems have their staunch adherents. A count of 22 nets revealed 11 of each type (February, 1930). Figure 7 shows a mackerel bag with vertical strips.

In all ring net bags the webbing is hung loosely on the cork and lead lines to allow the bag to hang deep and bulge out behind the lines when the net is being hauled. As a rule, the lead line is 5 or 10 per cent shorter than the cork line. This aids in scooping the bottom of the net under the fish. The method of hanging the webbing varies greatly. In a large proportion of the nets the bag is simply a huge rectangular

piece of webbing from 15 to 30 per cent longer than the cork line on which it is hung. The amount of slack is always greater at the landing bag. Except for this piece the webbing may be hung uniformly throughout its entire length, or may be considerably looser near the middle. The latter practice is more common. One successful fisherman uses the following amount of slack: For every 10 feet of cork line he has 12 feet of webbing on the ends of his bag, 13 near the middle and 13½ feet at the landing sack (January, 1930). In and near the landing sack some men use as much as 16 feet of webbing for every 10 feet of cork line. In addition to having the landing sack hung more loosely on the cork line, many fishermen "take it up" on the surrounding webbing. For instance, there might be 12 or 13 feet of landing sack sewed to 10 feet of other webbing. This "take-up" is accomplished by laying the two pieces of webbing edge to edge, looping each mesh to the one opposite it and then, as often as necessary, looping a mesh from one piece to two on the other, thus "taking-up" one mesh. The method is shown in figure 3 (pt. 5).

Some bags are more complicated in design than the type described above. In some cases, for instance, when the strips of webbing are all laid horizontally, the middle strips are longer than the upper and lower ones. In a 4-strip bag, the top one might be 120 fathoms long, the next two 130 and the bottom piece 120 fathoms. The longer strips are taken in to the same length as the shorter ones to make the ends of the bag square. This design reduces the amount of webbing in the bag without a corresponding reduction in total length or in the amount of bulge which the webbing shows when being fished. Another type of bag has the top strip of webbing longest, and each lower one successively shorter. The theory is to have the bottoms of the two wings closer together than the upper edges, thus lessening the possibility of the fish diving out of the net. In some ring net bags, particularly those made largely of vertical strips, the center is a few fathoms deeper than the ends. The resulting bulge helps to cut off sounding fish when the net is being pursed.

The wings of a sardine ring net are more lightly constructed than the bag. The cork line is strung with 3- or 4-inch corks, spaced so that there is one or a pair of corks every 14 to 18 inches. Selvage is not needed in the wings since the corks are smaller and the webbing is coarser so that almost every mesh can be fastened to the cork line. There is always, however, a strip of 3- or 4-inch mesh webbing, usually about 2 fathoms wide, between the cork line and the coarser webbing underneath. (Figs. 2 and 6.) The corks are laid on this strip when the net is being piled so that there will be no danger of their slipping through the coarse mesh and catching when the net is being paid out.

The lead line is strung with 1½- to 4-ounce sinkers spaced so as to have from 3 to 8 ounces of lead to the foot. Some light nets have wings with no heavy webbing between the lead line and the remainder of the net. In most cases, however, there is a strip of 3- or 5-inch mesh heavy webbing similar to that used in the bag. The purse rings are fastened on the lead line just as on the bag. Some nets have the rings farther apart in the wings and a fair proportion, especially of the lighter nets, have no purse rings at all on the last 15 fathoms or so of each wing.

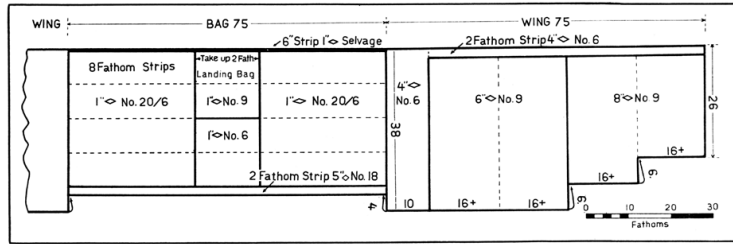


FIG. 6. Bag and one wing of a light sardine ring net 225 fathoms long. A type used during the 1928-1929 season. Note the comparatively gradual taper of the wing. Diamond is symbol for mesh. Dimensions are in fathoms. Dotted lines separate strips of like webbing; solid lines separate unlike webbing. Curved arrows show take-up. Net is gathered at end of wing.

FIG. 6. Bag and one wing of a light sardine ring net 225 fathoms long. A type used during the 1928-1929 season. Note the comparatively gradual taper of the wing. Diamond is symbol for mesh. Dimensions are in fathoms. Dotted lines separate strips of like webbing; solid lines separate unlike webbing. Curved arrows show take-up. Net is gathered at end of wing

The webbing of the wings is generally of 3 sizes. The usual range is from 4-inch mesh (stretched web) next the bag to 8-inch mesh on the ends. In general each wing has 6 to 12 fathoms of 4-inch mesh and from one-third to two-thirds of the remainder of 6-inch mesh. The ends are of 7½-, 8-, or 9-inch mesh. Some wings, especially those which are short, are made entirely of 1-size mesh, usually 8-inch, occasionally 10. As a rule the 4-inch mesh is No. 6, and the remainder No. 9. Coarser twine is occasionally used on heavy nets. At the end of each wing the cork and lead lines are brought together; the webbing is gathered and may be fastened directly to the ropes, or may be sewed to a small piece of exceedingly heavy webbing which in turn is gathered up. (Fig. 3, pts. 3 and 6.)

The strain on the wings of a ring net is mostly in a horizontal direction. Therefore to have the knots in the proper position, the strips of webbing used in the wings must be laid vertically. The widths of the strips used vary greatly; 150 meshes for the 8-inch and 200 meshes for the 6-inch are quite popular. This amounts to 16# fathoms when the webbing is new. Tanning shrinks it a few feet.

Unlike that of the bag, the webbing in the wings of a ring net is hung on the cork line with almost no slack. Webbing pulled tight is much less likely to let fish escape than when it is slack and the meshes are hanging open. For this reason the webbing, instead of being 20 or 30 per cent longer than the cork line, is rarely 5 per cent longer. Some fishermen, when hanging webbing on a new cork line, make the web and the line exactly the same length. The new line when wet shrinks enough more than the web to provide the right amount of slack. After the line has lost most of its power to shrink, the webbing must be rehung. The lead line of the wings, in addition to extending along the lower edge of the net, must reach to the surface. For this reason it is usually made somewhat longer than the cork line.

As a general rule, the wings of a sardine net are deeper at the base than is the end of the bag. This difference is usually 6 fathoms or less. (Figs. 2 and 6.) The base of the wing is of course taken up to the same depth as the end of the bag. The purpose of the extra depth is to keep the ends of the bag down as deep as possible when the net is being hauled and to have the wings form a floor to the net to help head the fish upward. When the wings are only 2 or 3 fathoms deeper than the bag, this last effect is probably lacking since the wings are stretched tight and do not hang as large a proportion of their theoretical depth as does the bag.

During the 1928–1929 season, most of the wings were tapered¹² fairly evenly from the base out to the ends (fig. 6), much after the fashion of the wings of the old lampara nets. It was found that this gave the fish entirely too good an opportunity to escape near the boat, and during the 1929–1930 season the wings were kept their full depth almost to the ends. (Compare figs. 2 and 6.) The 1928–1929 net (fig. 6) has a taper probably less marked than the average. Some of the nets used to taper down to as little as 15 fathoms near the end. An extreme type of net of another sort is shown in the upper figure for 1929–1930.

¹² Tapering is accomplished by having the strips of webbing at the end of the wings shorter than those nearer the base. Each strip is cut square on the end, and when two pieces of unequal length are sewed together, one edge of the longer is taken up to the same length as the shorter piece.

(Fig. 2.) This net is used on a large ring net boat capable of carrying well over 100 tons of sardines. The wings are too short to have any possible effect in keeping the corners of the bag down or toward forming a floor when the bag is being pursed. The wings of such nets serve merely to give additional length, without greatly increasing the weight or cost. The other net shown on the same page is typical of those used by numerous small boats of the purse seine type.

The purse lines used on sardine ring nets are of manila hemp and range from 2½ to 3¼ inches in circumference. The size of line depends largely on the boat using it. Large purse seine boats require lines of 3¼-inch circumference while 3-inch is commonly used on smaller boats of this type. Lines of 2½ and 2¾ inches are used on small ring net boats. The central few fathoms or "lifting" part of the line is employed to hoist the bunched purse rings, and since it receives more strain, is commonly about a quarter-inch larger than the remainder. All sizes given above refer to the lighter part of the line. For convenience

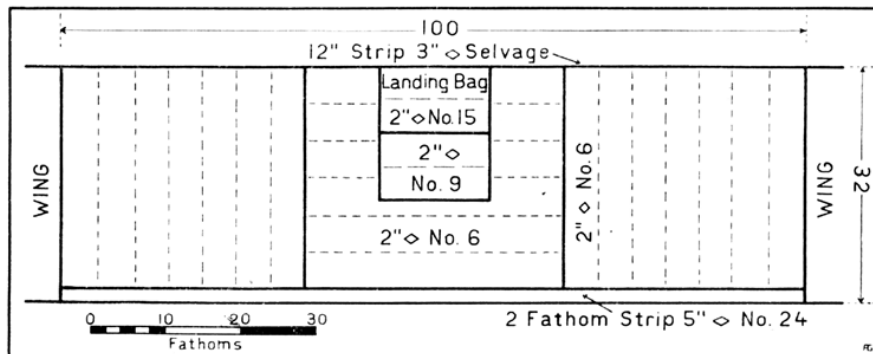


FIG. 7. Bag of a mackerel ring net constructed of vertical strips of webbing. Diamond is symbol for mesh. Dimensions are in fathoms. Dotted lines separate strips of like webbing; solid lines separate unlike webbing.

FIG. 7. Bag of a mackerel ring net constructed of vertical strips of webbing. Diamond is symbol for mesh. Dimensions are in fathoms. Dotted lines separate strips of like webbing; solid lines separate unlike webbing

in hauling, purse lines are divided at the center and joined with a figure eight link. Since half the line is reversed with every haul, a "lifting piece" must be spliced onto both ends of at least one of the two halves and one end of the other.

3.2. Mackerel Ring Nets

Mackerel ring nets are sometimes as much as 60 or 70 fathoms shorter than the sardine nets used by the same boat, although in most cases the difference is much less than this and many boats have their mackerel and sardine nets exactly the same length. Mackerel nets are sometimes more lightly corked and leaded. The greatest difference between the two is in the webbing of the bag. (Fig. 7.) The majority of mackerel fishermen use 2-inch mesh, No. 6. A few use 2½-inch mesh but since this size gills small mackerel it is not popular. The landing bag is of 2-inch mesh, No. 9 to 15, or of 1¼- to 1½-inch mesh, No. 9 or 12. When sardines are schooling with the mackerel, the finer webbing must be used in the brailing piece to keep the small fish from being gilled. As a rule not many of the sardines become panicky or crowded enough to gill themselves in the 2-inch mesh until they are concentrated in the landing sack. There is not much need for heavy webbing to reenforce the net near the brailing piece. Schools of mackerel are smaller than those

of sardines, and the No. 6 webbing used throughout the bag is quite strong enough. The only reenforcement commonly seen is a piece of 2-inch mesh, No. 9, directly under an extra heavy brailing piece. The strips of webbing used in the bags of mackerel nets are usually 200 meshes wide. This amounts to about 5½ fathoms.

The bag of a mackerel ring net is usually a little shorter than that of the sardine net used by the same boat. The wings of the two are so similar that some fishermen use the same pair for both nets and transfer them from one bag to the other. The wings and bag of a mackerel net are usually the same depth. Sometimes the wings are made deeper, but the comparatively coarse-meshed mackerel bag comes through the water more easily and does not need to be held down on the corners as does a sardine bag.

The purse lines of mackerel ring nets are in most cases the same as those of sardine nets. A few—very few—of the smallest mackerel boats use purse lines of 2¼-inch circumference.

3.3. Barracuda and Market Ring Nets

Mackerel ring nets are used for barracuda fishing also and to some extent by small boats for general market fishing. Those used by the smaller market boats are not so large as the average mackerel net.

3.4. Tuna Ring Nets

A few boats have tried ring nets for tuna fishing, using huge nets constructed especially for the purpose. They have had moderate success. On account of the comparatively light construction of the ring net, they have not attempted to take large tuna. The members of one crew estimate that their net is capable of holding 30- to 40-pound fish. The length of the net of this particular crew is about 340 fathoms, each wing is 120 fathoms and the bag 100 fathoms. The net is a little over 30 fathoms deep throughout its entire length. The bag is constructed of 5-inch mesh of about 21-thread twine. The brailing piece is 35 fathoms long by about 16 deep, of 4-inch mesh, 36-thread twine, and the wings are of 8-inch mesh, No. 9. The corks and leads are spaced very much like those of a large sardine net.

3.5. Sardine Ring Nets at Monterey

The sardine ring nets at Monterey during the 1929–1930 season were a little shallower and much shorter than the ones at San Pedro. Those used by the launch and lighter combinations ranged from 110 to 175 fathoms long and from 25 to 35 fathoms deep. Five purse seine boats at Monterey used ring nets. At the start of the season at least one of these nets was over 200 fathoms long. Apparently the schools are much larger or denser at Monterey than at San Pedro, as users of comparatively large nets frequently had their webbing badly torn by the weight of fish. In consequence, most of the fishermen who started with long nets soon shortened them. By the end of the season few, if any, 175-fathom nets were still being used by the launches, and it is doubtful whether any of the purse seine boats had ring nets very much over 190 fathoms long.

Monterey nets, besides being smaller than those at San Pedro, are quite different in design. The wings are usually exceedingly short—from

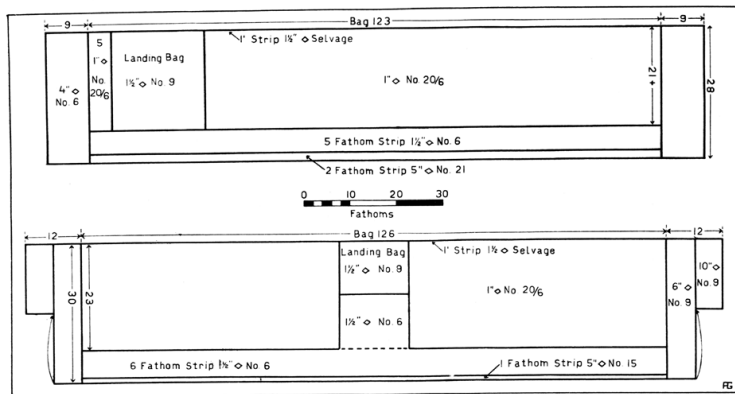


FIG. 8. Two Monterey ring nets. The upper, 141 fathoms long, has the brailing piece on one end. The lower, 150 fathoms long, is of the more common type with the brailing piece in the center. The strip of No. 6 webbing at the bottom of these nets is a Monterey feature seldom if ever used at San Pedro. Diamond is symbol for mesh. Dimensions are in fathoms. Dotted lines separate strips of like webbing; solid lines separate unlike webbing. Curved arrows show take-up. Nets are gathered at each end.

FIG. 8. Two Monterey ring nets. The upper, 141 fathoms long, has the brailing piece on one end. The lower, 150 fathoms long, is of the more common type with the brailing piece in the center. The strip of No. 6 webbing at the bottom of these nets is a Monterey feature seldom if ever used at San Pedro. Diamond is symbol for mesh. Dimensions are in fathoms. Dotted lines separate strips of like webbing; solid lines separate unlike webbing. Curved arrows show take-up. Nets are gathered at each end

4 to 12 fathoms, although occasionally 35- to 40-fathom wings are seen. Nets with long wings are referred to as "San Pedro style." Aside from the difference in wing length, there are two distinct types of ring nets in use at Monterey. (Fig. 8.) One has the brailing piece in the center and is hauled from both ends. The other type has the brailing piece at *one end* of the bag and is hauled from one end much like a purse seine. This last style never has a wing more than 12 fathoms long next the brailing piece. The other wing is usually from 4 to 12 fathoms long, but may be as much as 35 fathoms or more.

4. TYPES OF BOATS USING RING NETS

4.1. Purse Seine Boats

The largest boats which fish with ring nets at San Pedro are those of the purse seine type, shown in figure 9 (pts. 1-4). Part 1 is a purse seiner with turntable and seine. Part 2 is a somewhat larger boat with the turntable removed for ring net fishing. This boat is about as large as any being used with a ring net. Parts 3 and 4 are small purse seine boats, each carrying a ring net. Boats of the purse seine type now used for ring net fishing range from 55 to 80 feet¹³ in length, 14 to 20 feet in beam, and 5½ to 10 feet in depth. Net tonnages are from 18 to 55. Engines are occasionally as small as 50 horsepower but usually range from 70 to 200 horsepower. A popular size among the largest boats is 180 horsepower. Diesel engines are used by all the larger boats and almost all the small ones.¹⁴ Hold capacities are from 20 to 115 tons and total capacities are from 60 to 140 tons or more. Side boards are carried to make deep deck-loads possible and are frequently used by the smaller boats but seldom by the larger ones. On all purse seine boats sleeping quarters are provided for the entire crew.

The largest boats do not seem to be quite as satisfactory with ring nets as are the smaller ones, since the weight of a large boat is more liable to tear a ring net in a heavy sea. Some fishermen have reduced this risk by increasing the strength of their nets. The commonest size of purse seine boat with a ring net is about 60 to 65 feet long, 14 to 16 feet wide, and 6 to 7½ feet deep. Such boats range from 20 to 28 tons net. The engines are usually from 70 to 110 horsepower. Capacities are 30 to 45 tons of sardines in the hold and total capacities are 65 to 80 tons. Boats of this type are shown in figure 9 (pts. 3 and 4).

4.2. Southern Ring Net Boats (Former Lampara Boats)

The commonest ring net boats at San Pedro are former lampara boats of the sort shown in figure 9 (pts. 5-7). A few are still used with lamparas, principally at San Diego. In the southern California boats, bows are wedge-shaped, neither they nor the sides show much flare and the decks are comparatively flat. Boats of this type which fish with ring nets range from 35 to 60 feet in length, 9 to 14 feet in width and 3 to 5 feet in depth. Net tonnages are from "under 5" to

¹³ A few larger purse seiners have been built but most of them have fished only for tuna and none have used ring nets.

¹⁴ Gasoline boats are so much more expensive to operate that there is little money to be made on them, consequently they are avoided by most of the good fishermen. In addition the fire risk is far greater when gasoline is used for fuel. The gasoline engines now in use were installed before diesel engines had been fully established as practical.

14 tons. The engines are usually from 15 to 50 horsepower. The majority are diesel although gasoline engines are quite common. Carrying capacities range from 7 to 50 tons. Some of the boats have no holds and so have to carry all their loads on deck. Others have small holds capable of carrying up to 12 tons. A few of the largest are built more on purse seiner lines and are able to take about 20 tons below deck. A few of the largest boats have sleeping quarters for 6 or 8 men but most of them are equipped for no more than 3 or 4.

It would be possible to divide these boats into two groups: cannery and market boats. In general, those capable of carrying more than 20 tons were built for Japanese fishermen, who formerly used them with hook-and-line to catch albacore in the summer and with lamparas for sardine fishing in the winter. Albacore are no longer taken in any quantity in California waters and most of the boats now fish principally for sardines and mackerel with ring nets. Most of the smaller boats, including some which are smaller than any of the ring net boats, were originally built to fish for the markets with gill nets, trammel nets and other forms of gear. The majority are still used in this way and only a few fish with ring nets.

Boats which fish for the markets seldom have any need for side boards but may carry them just "in case." Cannery boats, on the other hand, have frequent need for side boards, especially during sardine season. When a boat is so heavily loaded that a man must either lay down a plank to walk on or wade through two feet of fish, the catch is sometimes covered with old webbing to keep the pelicans and sea gulls from devouring it. A fully loaded ring net boat is shown in figure 9 (pt. 7). Notice that the deck goes under water just forward of the cabin and from that point back it is entirely under water. The net has been tied down to keep it from washing away and the skiff is resting on top of the net. It is obvious that the boat could not stand any rough water with this load. Very rarely are even the smallest boats loaded this heavily when mackerel fishing, but during sardine season a boat with most of its deck under water is a common sight.

4.3. Northern Ring Net and Lampara Boats

Although there are sardine boats of the southern type used at Monterey and San Francisco, most of the vessels at those ports are of a different design. In general the northern boats flare conspicuously at bow and sides and have arched decks. Most of those at Monterey during 1929 were from 30 to 50 feet long, 10 to 13 feet wide, 3 ½ to 5 feet deep, and had engines of from 15 to 40 horsepower, most of which burn gasoline, although there are a few with diesel engines. When fishing for sardines, the Monterey boats tow lighters of up to 70 tons capacity; the capacity of the outfit is measured by that of the lighter. Between sardine seasons the boats fish for the markets and pile their catches on deck.

At San Francisco no lighters are used, side boards are kept in place, and the sardines are piled on deck.

4.4. Boat Capacities

Two charts are included to give an idea of the size of boats used with ring nets and purse seines. Figure 10 gives the approximate distribution of the capacities of the boats at San Pedro which fished for sardines

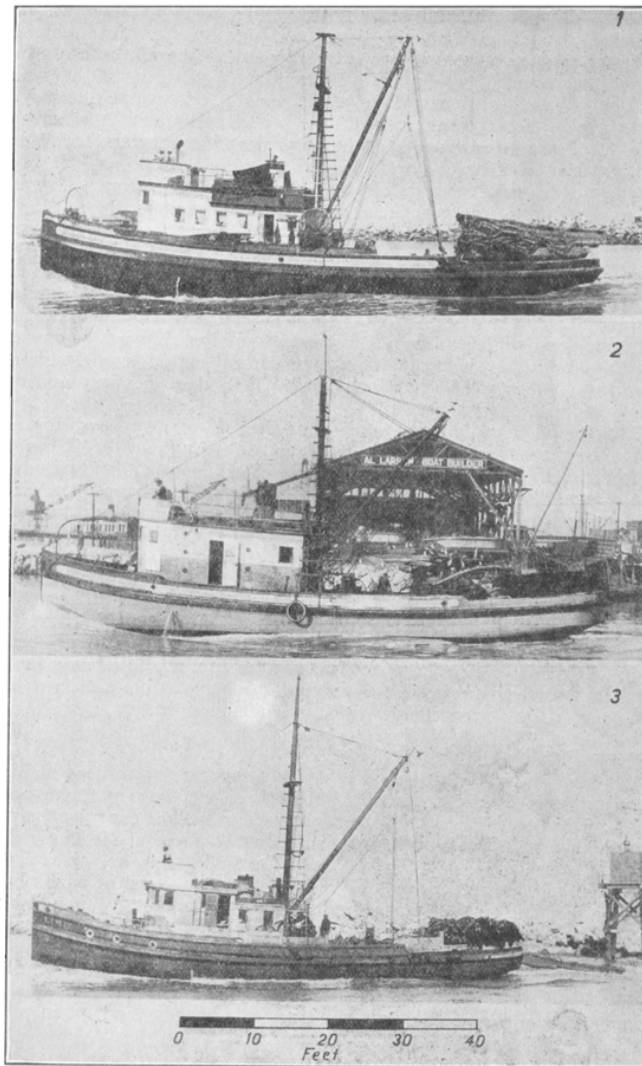


FIG. 9-A

- Part 1. Purse seine boat with turntable and seine.
- Part 2. Large purse seine type boat with turntable removed for ring net fishing.
- Part 3. Small purse seine type boat with ring net.

FIG. 9-A

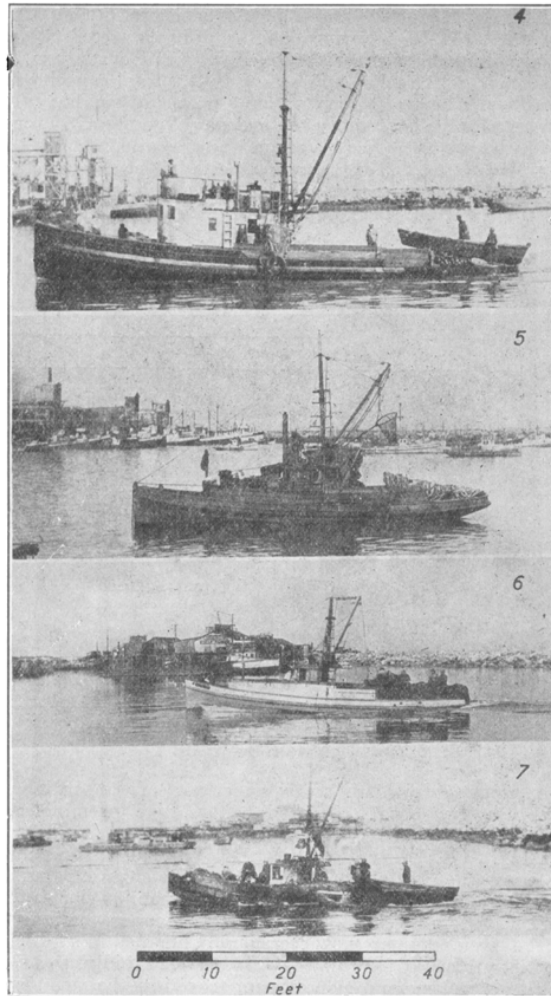


FIG. 9-B

Part 4. Small purse seine type boat with ring net. The boat is partly loaded.
Part 5. Cannery ring net boat (formerly lampara boat).
Part 6. Ring net boat. This size is about at the dividing line between the cannery and market boats.
Part 7. Heavily loaded ring net boat. Notice that the deck is under water from in front of the cabin to the stern. The skiff is resting on the net. This boat was at an angle to the camera and does not look its full length.

FIG. 9-B

during the 1928–1929 season and for mackerel during May, June and July in 1929. There were two classes of boats present which made it necessary to use total capacities since the small boats carry a much greater percentage of the load on deck. By the total capacity is meant the largest load a boat can carry without danger of sinking. This is a very rough figure. The weather can make a difference of 15 tons in the amount which may be carried; captains disagree on how far a boat may be safely loaded, etc. Many boats, especially the larger ones, have never been fully loaded so their total capacity is unknown. During the 1928–1929 season, 111 boats fished for sardines. This number included 75 purse seine boats, 21 of which used ring nets, and 36 small boats, all of which used ring nets.

Since the approximate total capacity of only 57 per cent of the purse seiners was known (as compared with 89 per cent of the small boats)

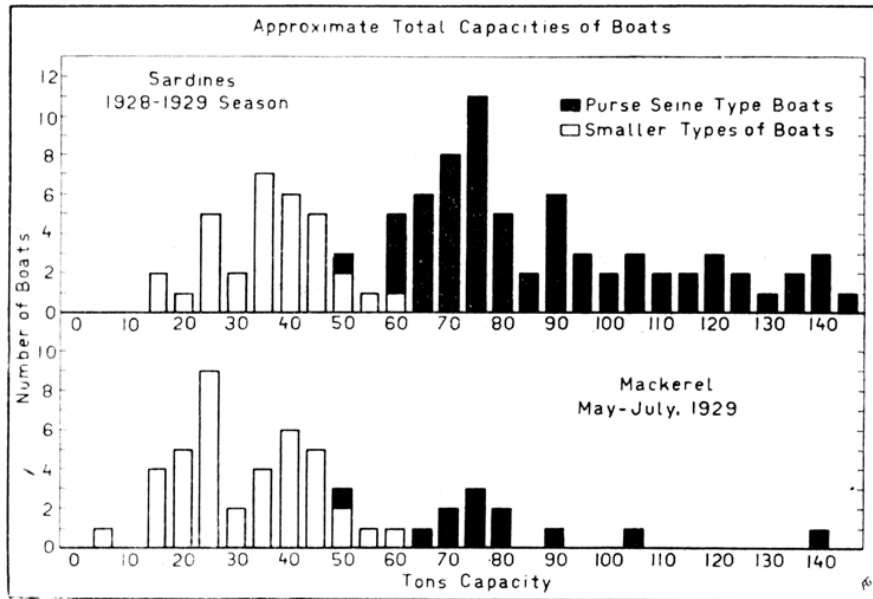


FIG. 10. Approximate total capacities of purse seine type and small boats (mackerel and sardine fleets are separate). The purse seine part of the sardine curve is weighted.

FIG. 10. Approximate total capacities of purse seine type and small boats (mackerel and sardine fleets are separate). The purse seine part of the sardine curve is weighted

it was necessary to weight the purse seiner part of the sardine curve in order to give these boats their proper relative prominence. Hold capacities of boats of unknown total capacities were taken into account in doing this. It will be noticed that there is a much larger number of boats between 60 and 80 tons capacity than over any similar size range. These are old purse seiners, most of which were built prior to the 1920–1921 period of depression. They were not intended for long trips or for as large tonnages as are now occasionally handled in sardine fishing. The distances traveled for tuna have increased rapidly, so to compensate for the extra time and money spent traveling, the men stay longer on the grounds and try to obtain larger loads. As a result of these conditions, new boats have been built larger and larger. (Fig. 10.) Note that among the biggest boats there is a wide range of sizes but no great number of boats at any one size.

During May, June and July of 1929, there were 65 net boats fishing mackerel for the San Pedro canneries. This number included 15 purse seine boats, 8 of which used ring nets, and 50 small boats, all of which

(I believe) used ring nets. One or two may possibly have used lamparas during this period. Two boats are known to have done cannery mackerel fishing with lamparas during 1929, but neither made any deliveries during the three months under discussion. In making the lower half of figure 10, it was not necessary to do any weighting, as total capacities of about 80 per cent of each of the two types of boats was known. The mackerel fishery, as can be seen in figure 10, is essentially

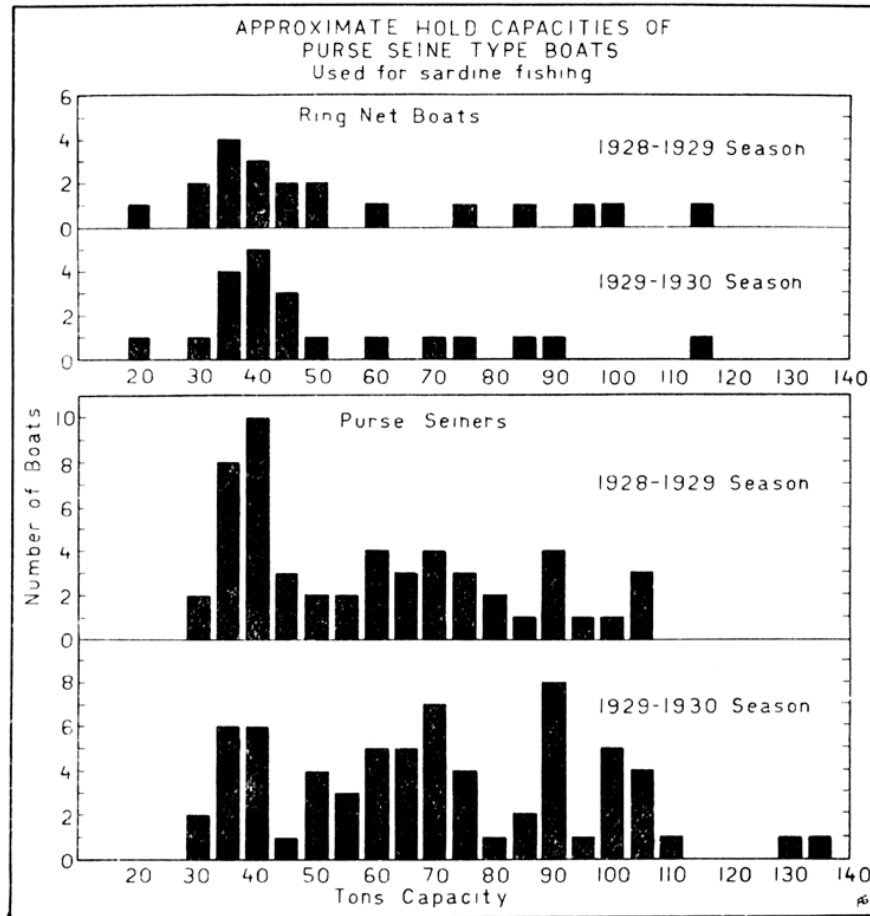


FIG. 11. Approximate hold capacities of purse seine type boats separated by gear.

FIG. 11. Approximate hold capacities of purse seine type boats separated by gear one of small boats. Long trips are never made, loads are small, and the canneries usually place the boats on a limit of 10 tons or less (1928-July, 1930). (See footnote 18, p. 56.)

A comparison of the boats of the purse seine type used at San Pedro during the 1928-1929 and 1929-1930 sardine seasons is given in figure 11. In this case boats of one type are divided according to gear. Hold capacities are used since they are known for most of the boats and are more accurate than total capacities. Notice that there is a tendency toward smaller ring net and larger purse seine boats. Part of the decrease in the number of smaller purse seiners was due to the migration of many boats of this size to Monterey waters for the 1929-1930 season.

TABLE 5
Sardine and Mackerel Net Boats Delivering to Canneries

	Sardines		Mackerel
	1928-1929	1929-1930	May-July 1929
Purse seine boats with purse seines.....	54	75	7
Purse seine boats with ring nets.....	21	21	8
Small boats with ring nets.....	36	30	50
Small boats with lamparas.....	0	2 ^a	0
Totals.....	111	126	65

^a These two boats and one other were small market craft which fished sardines often enough to be included on this list. The other boat changed to a ring net during the season.

TABLE 5
Sardine and Mackerel Net Boats Delivering to Canneries

5. OPERATION OF PURSE SEINES, LAMPARAS AND RING NETS

Irrespective of the kind of fish sought, the manner of actual taking varies little. In purse seine, lampara and ring net fishing the methods of locating the fish and starting the haul are much the same. The boat cruises back and forth over the fishing grounds while a man in the crow's nest watches the water for fish. In night fishing, the schools are located by the phosphorescent glow caused by their motion. The boat then passes close to or through the school, and by the manner in which the individual fish dart away the fishermen are able to tell the species and approximate size. In daylight fishing for sardines and other fish, the schools are located by seeing the fish break the surface, by the presence of sea birds, by the "bead" (bubbles) on the surface of the water, or by the change in the color of the water caused by a deep-lying school. Large predacious fish, such as barracuda, are sometimes located by trolling a lure through the fishing grounds until a strike is obtained.

Mackerel are usually taken during daylight hours by throwing ground-up fish or "chum" overboard. This attracts large numbers of fish to the boat. A large quantity of chum is then given to a man in the skiff; he continues throwing it into the water as the boat slowly pulls away and leaves him. The boat waits a few minutes in order to be sure that the entire attention of the school is focused on the skiff; then it "shoots the net" and circles skiff, mackerel and all. The man in the skiff continues chumming the school until it is trapped. Part of one haul usually serves as chum for the next. Sometimes live bait is used in place of ground-up fish.

The net is carried with one end attached to a skiff, hereafter referred to as the "skiff end," and the other—"boat end"—is fastened to a heavy manila "haul line" on the boat itself. On the way to and from the fishing grounds the skiff is usually carried on board, but while cruising for fish it is towed. When a sufficiently large school is located, the boat maneuvers into the proper position. The skiff is then released, its weight carries the end of the seine overboard and the boat circles the fish at full or reduced speed, depending on the action of the fish. European crews circle to the left while Japanese circle to the right. Lamparas are usually circled more slowly than the other nets, as there is danger of tearing the floor of the bag at top speed. As the circle approaches completion, speed is lessened, the boat stops and picks

up the skiff. This part of the process takes two or three minutes. If the circle is so large that the net will not reach around it, the haul line, fastened to the boat end of the net, is paid overboard under strain and hauled in as soon as the skiff is picked up. (Fig. 17.) From this point on, the three types of nets are all handled differently. Figure 12 shows the position of each form of gear at the beginning of the haul.

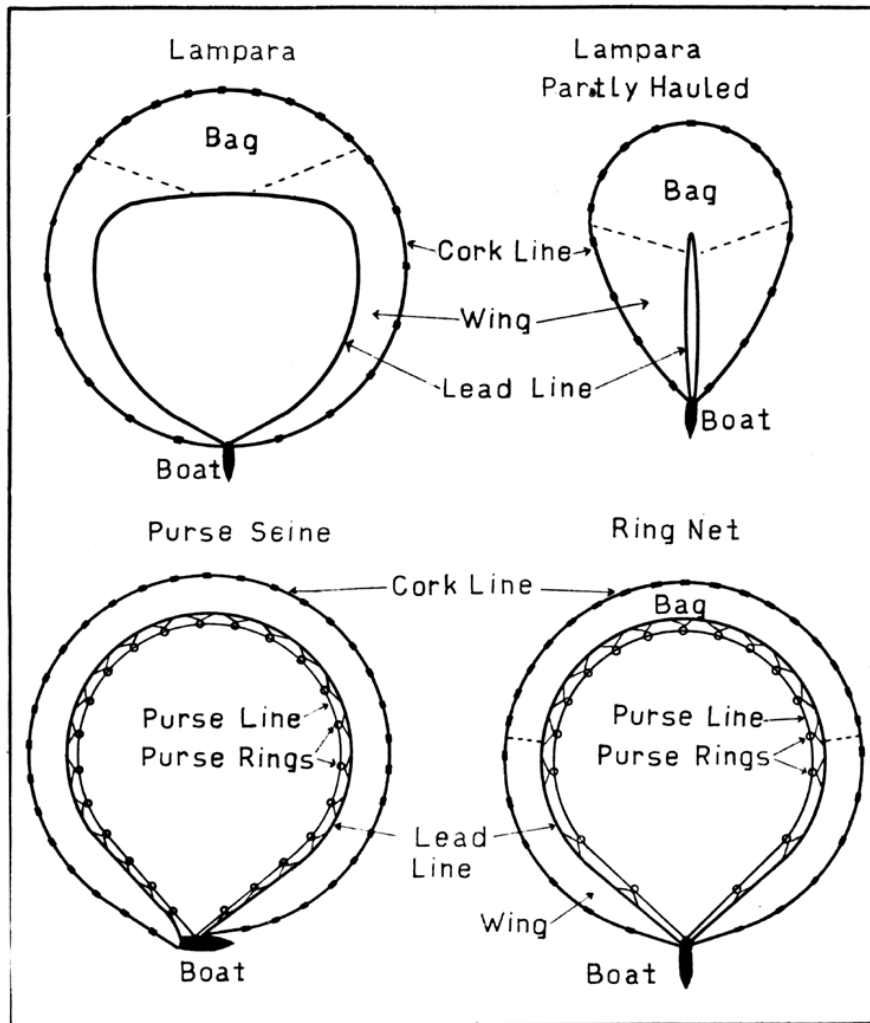


FIG. 12. Diagram showing position of boats in hauling lampara, purse seine and ring net. All nets are shown before hauling or pursing has been started. The lampara is also shown partly hauled. (Scale: Lampara boat, 50 feet; other boats, 60 feet; all nets, 200 fathoms.)

FIG. 12. Diagram showing position of boats in hauling lampara, purse seine and ring net. All nets are shown before hauling or pursing has been started. The lampara is also shown partly hauled. (Scale: Lampara boat, 50 feet; other boats, 60 feet; all nets, 200 fathoms.)

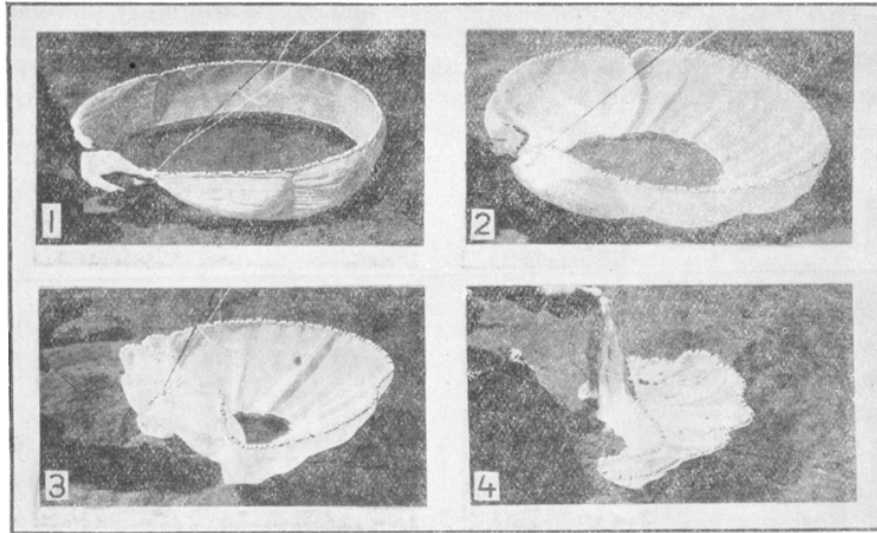


FIG. 13. Pursing a model net. Part 1: Just after the completion of the circle. Parts 2 and 3: Early and more advanced stages of pursing. Part 4: Pursing completed, rings and lead line out of water. A full sized net would tend to bulge and wrinkle more. This model is the shape of a 200 by 31 fathom net. A typical San Pedro sardine ring net is about this size and shape; a sardine purse seine is shallower; and a Monterey ring net is much shorter and a little shallower, making it proportionately deeper. Like a purse seine or a Monterey ring net the model is pursed completely shut before any hauling is done.

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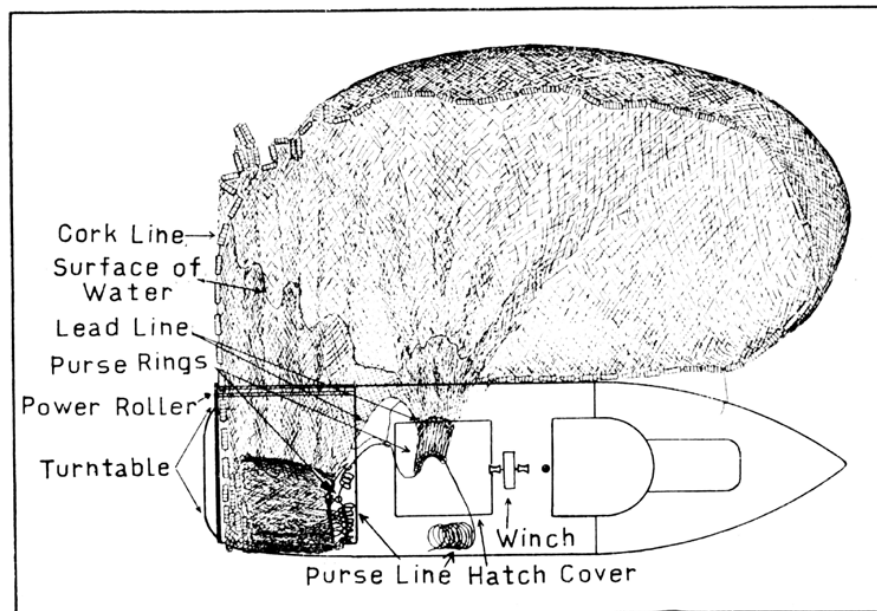


FIG. 14. Diagram of a partly hauled purse seine. Pursing is completed and the purse rings and lead line are lifted on deck before hauling is begun.

FIG. 14. Diagram of a partly hauled purse seine. Pursing is completed and the purse rings and lead line are lifted on deck before hauling is begun

5.1. Purse Seines

When a purse seine has been circled and the skiff picked up, the two ends of the purse line are brought through pulleys at the *side* of the boat (fig. 12), and the net is pursed (fig. 13) with the winch; both ends of the line are pulled in at equal speed. While this is going on, the brail¹⁵ lines are pulled in and the cork line is fastened to the rail at both ends of the boat and on each side of the purse line pulleys in order to keep the boat from passing over it. Pursing continues until the rings are all gathered at the side of the boat. A piece of rope is looped around the bridle lines just below the rings and hooked onto the boom. The rings and the entire lead line of the net are then hauled aboard. The entire pursing operation takes about 8 to 15 minutes. Once pursing is finished and the lead line is aboard, there is no way for the catch to escape, except by jumping the cork line, or in the case of exceedingly large fish, by tearing the webbing. The figure eight link which joins the two halves of the purse line is unfastened and the line is removed from the rings and fastened to the boat end of the net. This reverses half the line every haul, since the top of one coil, which was the middle of the line, now becomes the end. Hauling of the net is then commenced. The power roller of the turntable is set in motion and the crew is thereby relieved of most of the weight of the net. The hauling is done over the side of the boat, and the corks are piled on the side of the turntable which is at that time nearest the stern of the boat. One man pulls the purse line through the pile of rings on deck and piles it on the turntable. Another "clears the rings," *i. e.*, sees that they do not catch, and passes them onto the table as the net is hauled. Rings, purse line and lead line are all piled on the edge of the table opposite the corks. Hauling continues until the fish are concentrated in a small part of the net at the skiff end. The method of using the skiff to support the cork line and to brail the fish out of the net are the same as those used with the other nets described. Figure 14 shows a purse seine partly hauled. One coil of purse line and part of the second has been stacked on the turntable with part of the rings.

The use of a steel purse line slightly changes the method of hauling. The steel line is carried on a drum on top of the cabin. The net, in going overboard, pulls the line off the drum. When too large a circle is made the steel purse line as well as the haul line must be paid overboard, since the boat end of the line can not be fastened to the net while everything is in motion. Pursing is done in the same way as with a manila line, except that one end of the line is wound onto the drum and removed from the rings and pulleys; the two halves are linked together again and the coil of line lying on deck is wound onto the drum. The end is passed through the rings and fastened to the *skiff* end of the net as soon as it is hauled aboard. The chief differences are that no part of the steel line is reversed with each haul and that the line is kept on the drum instead of being piled on the turntable while the net is being hauled, thus requiring one less man.

5.2. Lamparas

With the lampara, as formerly used for sardines at San Pedro, the circle was made in the manner described for the purse seine except that some of the smaller boats substituted a buoy for the skiff. When the

¹⁵ Brail lines gather the ends of a purse seine; they are not used in brailing.

circle was completed, hauling was commenced from both ends. (Fig. 12.) Each half of the crew pulled a wing over each side of the stern of the boat, care being taken to pull the two at the same speed. Hauling pulled the lead lines of the two wings together under the fish and helped to herd them into the bag. (Fig. 12.) Once the wings were on board, the lead line of the bag soon followed as it was much shorter than the cork line. Lifting the lead line trapped the fish and gave the crew a chance to take a short rest. This pause had the extra advantage that it gave the fish time to exhaust themselves and calm down. The cork line and webbing were then pulled on board until the fish were concentrated in a small enough space to permit their being brailed into the boat. After hauling, the net had to be partly re-piled for the next

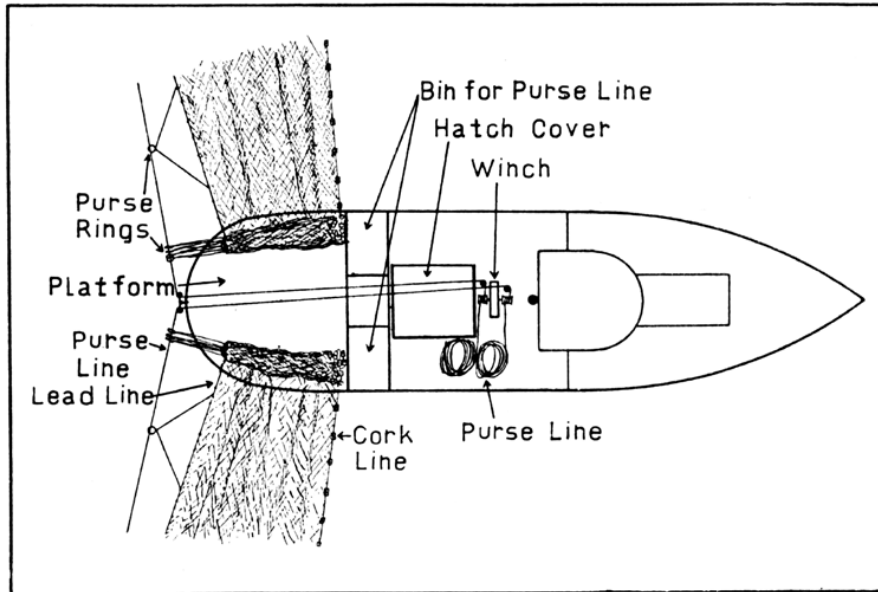


FIG. 15. Diagram of a ring net boat showing the method of hauling the net. (Compare with fig. 18.)

haul, since it was necessary to pay the net out from one end, and after the haul both ends were on the bottom with the bag piled on top.

At Monterey, lamparas are hauled over the side of the boat.

5.3. Ring Nets

At San Pedro the ring net is carried in the stern of the boat. The corks are usually piled farthest forward, the webbing next to the rail, and the lead line along the inside edge of the pile of webbing. The purse rings are stacked beside the net. (Figs. 4 and 16.) The purse line runs through them and is coiled¹⁶ in a specially partitioned space immediately forward of the net. Sometimes the entire line is in one huge coil, but as a rule two coils are used. The line runs from the skiff end of the net through half of the rings, forward into the first coil of line, back and through the other half of the rings into the second coil, and is fastened to the boat end of the net. The manner of circling the fish is the same as that previously described. When the circle has been completed, the ends of the purse line are passed through pulleys

¹⁶ Up to the present time no steel purse lines have been used on ring nets.

at the stern of the boat and pursing is commenced. At the same time the crew starts hauling the wings over each side of the stern of the boat. (Figs. 15, 18 and 19.) Pursing is done more slowly than with the purse seine since the fish must not be crowded closely until the coarse-meshed wings are in. The shorter the wings the faster the pursing can be done. As the net is hauled, the purse rings are allowed to accumulate at the stern of the boat. (See frontispiece.)

When the pursing is complete, the lead line is at the surface of the water. With light nets the crew often lifts the entire lead line on board by hand as the webbing is pulled in. In hauling heavy nets, a rope is looped around the bridle lines and hooked onto the boom, after which the rings and lead line are lifted aboard with the winch. (Fig. 20.) After the purse line is all on board, the two halves are unfastened



FIG. 16. Circling a school of sardines; daylight fishing. May, 1929.

FIG. 16. Circling a school of sardines; daylight fishing. May, 1929

and removed from the rings. A short piece of rope is strung through the rings to keep them in the right order and a man begins recoiling the line in the space provided for it. As with the purse seine half the line is reversed every haul. often with heavy nets the rope used for lifting the rings on board is looped around the bunched webbing of the bag and part of the net is hauled aboard with power. (Fig. 21.)

After the haul the ring net, like the lampara, must be repiled (fig. 25), and in addition, the purse line must be strung through the rings. As both these types of nets are made of tanned webbing, they must have at least the central part of the bag lowered overboard and rinsed thoroughly at the close of each day's fishing. Another practice is to make a complete empty haul, and thus rinse the entire net of the fish slime which would otherwise rot it. After washing, the net is salted while being repiled. Some men salt only part of the bag; others salt the

entire net. From one-half to four sacks of salt are sprinkled through the webbing to keep the slime from rotting it. Purse seines are not washed and are not often salted, as they are made of tarred webbing which does not absorb the slime so readily. When a purse seine is salted, however, it takes several times as much salt as a ring net.

5.4. Operation of Monterey Ring Nets

The ring nets used at Monterey are piled in an entirely different manner from those at San Pedro. (Fig. 27.) The net is near the port rail, the purse rings are farthest forward, then come the lead line and the bulk of the net. The corks are piled opposite the bag but nearer the center line of the boat. The net is paid out over the port side and the circle is made toward that side. This piling makes the lead line and purse rings fall nearest the center and the corks at the outer edge of the circle. Pursing is done through pulleys at the side of the boat directly opposite the winch and the net is hauled over the side. The Monterey ring net outfits use lighters to carry their fish. The lighters are used to drag the nets overboard in the same way that skiffs are employed at San Pedro. The different types of Monterey nets all have that much in common; the methods of hauling differ considerably, as follows:

1. Nets with the brailing piece in the center and moderately long wings are hauled much like the San Pedro nets.
2. Nets with short wings are completely pursed before hauling is begun.
3. Nets with the brailing piece on one end of the bag are hauled in quite a different manner, much more closely resembling the hauling of a purse seine. The brailing piece is on the end of the net nearest the lighter. The fish are circled in the usual manner, the lighter is "picked up" (*i. e.*, is met by the boat), and the net is completely pursed. Half the crew then hauls on each end of the net until the end of the brailing piece is on board. This part of the net is tied down and the entire crew hauls on the boat end of the net. The purse line is handled like that of a purse seine. Hauling from one end does not require as many men as hauling from both. It does take longer, but the time is not wasted since a net hauled from one end does not have to be repiled. The wing next to the brailing piece is exceedingly short and repiling it is hardly more than a matter of seconds.

5.5. Conditions Affecting the Operation of the Three Nets

Many factors must be taken into account in setting a lampara, ring net or purse seine. of first importance is the movement of fish. When a school is moving in a definite direction, it is necessary to set the bag of the net as squarely across its path as conditions permit. of course the larger the bag the more leeway there is in this respect. When a school strikes the fine webbing of the bag, it usually stops and mills around long enough to give the fishermen time to trap it. If the net is not set squarely and the fish strike a wing which is still hanging loose in the water, they usually pass right through it and out of the net. When a purse seine is being used, the only way fish can escape without sounding is by swimming under the boat. If they do sound before pursing or hauling is well under way their escape from any form

of gear is practically certain. Shallow water reduces the risk of the fish escaping by diving under the lead line. Often the fish are not moving in any definite course, but are merely idly circling or lying still. In such cases they can usually be taken by a haul properly made in any direction.

The net should be set in front of the fish—but it must be set so that the wind and current will allow it to be correctly hauled. The one direct effect of the wind is to drift the boat, although currents caused by the wind will drift both boat and net. Whenever possible, the net should be set so that the boat will be blown away from the bag. This tightens up both wings evenly, and with a lampara, helps close the

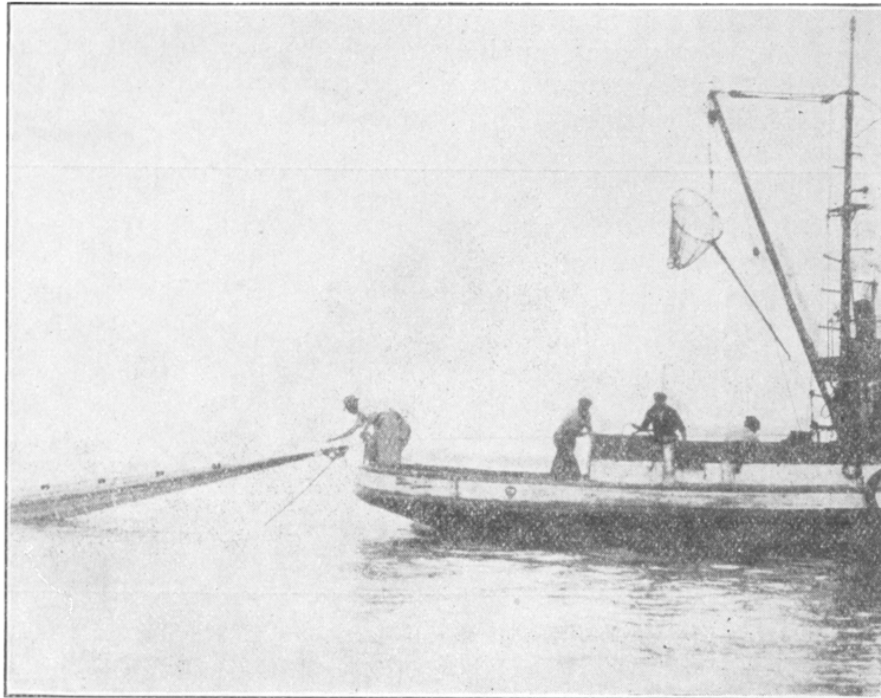


FIG. 17. Bringing in the haul line. The boat made too large a circle, and the net would not reach around it. A rope fastened to one end of the net was paid overboard until the circle was completed. This haul line is shown being pulled in with the winch. The purse line can be seen hanging from it. July, 1929.

FIG. 17. Bringing in the haul line. The boat made too large a circle, and the net would not reach around it. A rope fastened to one end of the net was paid overboard until the circle was completed. This haul line is shown being pulled in with the winch. The purse line can be seen hanging from it. July, 1929

lead lines faster than could be done without a wind. If the net is set at an angle to the wind, the boat will pull harder on one wing than on the other and allow the slack wing to hang open unless it is pulled in rapidly. As the angle is increased, the effect becomes more and more pronounced. Take the extreme case of the net set at right angles to the wind—the net is laid in a circle, and the boat is blown at a tangent to that circle. A lampara or light ring net is drifted directly toward one wing while the other is pulled tight. If the wind is so strong that the crew can not pull the slack out of the lee wing, the boat drifts past it and one side of the circle is caved in. Then the two sides of the net (including the sides of the bag) gradually drift together. When the net is in this shape, hauling the slack wing pulls its lead line away from the other instead of toward it. The action is less marked in a net which is being pursed. The effect is to reduce the space inside the "circle" and leave the bottom wide open, thus herding the fish out of

the net. In light winds the crew is usually able to keep the lee wing taut, though to do this it is sometimes necessary to tie down the windward wing and put every man on the lee side. If the lee wing is kept tight, the circle will not cave in and the sides of the bag will stay apart. As the lee wing is pulled the boat is gradually blown into the lee of the bag—the ideal position except for the way in which the bag is facing. Since the lee wing must be pulled in much faster than the other, it is all on board while there is still part or all of the windward wing in the water. When only one wing is in and the net is in a circle, it is obvious that the bag can not be coming in symmetrically. In this position the lampara, with its smaller bag, has an advantage over a light ring net. It must be remembered that the ring net, having shorter wings which can be pulled in more quickly, is less likely to get in this position. By pulling in the windward wing the light bag of a lampara can usually be swung into the proper position. Even though the net may finally be brought in properly under these circumstances,



FIG. 18. Pulling in the wings of a sardine ring net. Note purse lines and pulleys at stern of boat. (Compare with fig. 15.) May, 1929.

FIG. 18. Pulling in the wings of a sardine ring net. Note purse lines and pulleys at stern of boat. (Compare with fig. 15.) May, 1929

most of the fish usually escape, as the uneven pulling of the wings keeps the lead lines from closing. The bag of even a light ring net is too large to be swung into position. The tendency is for the wing to close across the face of the bag, which usually results in the fish becoming frightened at the close confinement and plunging through the wing. Pursing tightly only accentuates this difficulty, since it makes the space still smaller without trapping the fish.

A purse seine or heavy ring net with short wings is much easier than a lampara to handle in a cross wind. The purse seine has no wings, and the short ones of the ring net can usually be hauled in before the trouble starts. However, pursing a long bag pulls the boat into the circle of its net. In such cases a wind blowing at right angles to the direction of the haul tends to swing the bow over the cork line and so foul the webbing and corks on the bottom of the boat. If the wind is not too strong the man in the skiff can forestall this difficulty by lifting a few feet of cork line out of the water so that the boat can not pass over the net.

If the wind is high and the net is set so that the boat blows into the circle, loss of the fish is almost certain. The net, fastened at the stern

of the boat, acts as a sea anchor; the wind swings the bow over the net and the boat is soon inside its circle. The boat drifts, the circle is pulled out of shape and the fish are herded out through the wings or under the lead line. The turn of about 180 degrees pulls one side of the net over the other and perhaps into the propeller as well. The position is not regarded by the crew with any great enthusiasm.

If the breeze is light and the captain skillful, the bow of a ring net or lampara boat can be kept in the wind by moving an extra man or two onto the side toward which the bow is moving, and by pulling hard enough on that wing to swing the stern and get the boat pointed directly into the wind again. If this is done properly and the net is pulled in quickly enough, a successful haul can often be made. Obviously the

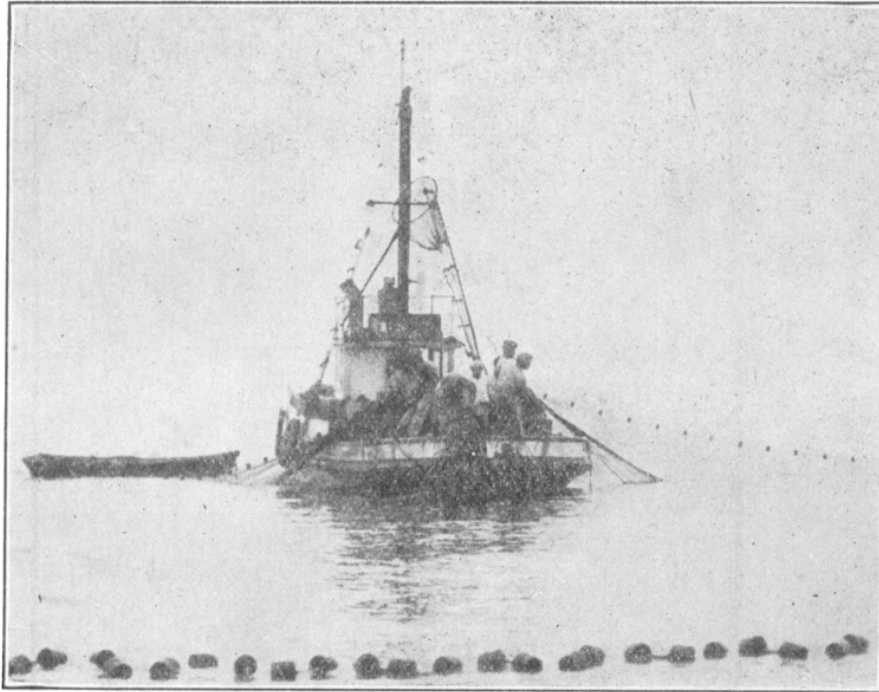


FIG. 19. Hauling a mackerel ring net. The coarse mesh of the wing does not show except where it is bunched. The boat circled these fish without chumming them. (See text, p. 38.) July, 1929.

FIG. 19. Hauling a mackerel ring net. The coarse mesh of the wing does not show except where it is bunched. The boat circled these fish without chumming them. (See text, p. 38.) July, 1929

practice is risky, since unless it is done perfectly the mess described above is likely to result. A purse seiner can not attempt this, since the net is hauled only from one end.

The wind is comparatively easy for a fisherman to figure out; he can always tell its direction and strength. The current is more difficult. It is not as easy to detect; it may or may not have the same strength at different depths; it may even be going in one direction at the surface and in another farther down. If the current were uniform at all depths it could be disregarded, as boat, net and fish would all be drifted along at the same speed. Unfortunately, this is rarely the case. Surface currents, such as those which are caused by nearly every wind, have about the same effect as the wind, in that they drift the boat faster than the net. Deeper currents, usually caused by the tides, drift the net faster than they do the boat, and consequently have somewhat the same effect as a wind blowing the opposite direction. Such currents

act more strongly on the lower part of the net, and accordingly are more likely to drift the lead line out of place than would a surface current or wind. There is one vital difference between the effects of current and wind. If a boat sets its net into the wind in shallow water and the lead line chances to drag on the bottom, the wind will still blow the boat away from the net. On the other hand, if a net is set with the current and drags on the bottom, that current will drift the boat into its net.

Correct setting of the net is no easy problem. It must be placed so that the combined effects of wind and current permit the haul to be made properly, and yet if the fish are moving part of the bag must be placed in front of them. often this is impossible. Assume, for instance, that a strong wind is blowing and the fish are moving rapidly in the same direction. A ring net or lampara boat could not set any part of its bag in front of the fish without being blown into the net. A purse seiner might stop the school by getting one end of his net in front of it, but in most cases the fish would swim past that end of the net before the circle was completed, or



FIG. 20. Lifting aboard the purse rings. A sardine ring net. May, 1929

would pass under the boat. In a somewhat lighter wind a purse seine or a ring net with very short wings could be set at an angle to the wind, and have part of its bag in front of the fish. When a school is going at right angles to the wind a purse seine or heavy ring net can easily make a successful haul. Under these circumstances a light ring net outfit can set at an angle of about 45 degrees to the wind and usually have at least part of the fish hit the bag and stay in the net. A lampara has such a small bag that it must be set almost directly across the path of the fish, and a cross wind would probably result in



FIG. 21. Pulling in the bag of a sardine ring net. The webbing in the center is being lifted with the winch. May, 1929.

FIG. 21. Pulling in the bag of a sardine ring net. The webbing in the center is being lifted with the winch. May, 1929

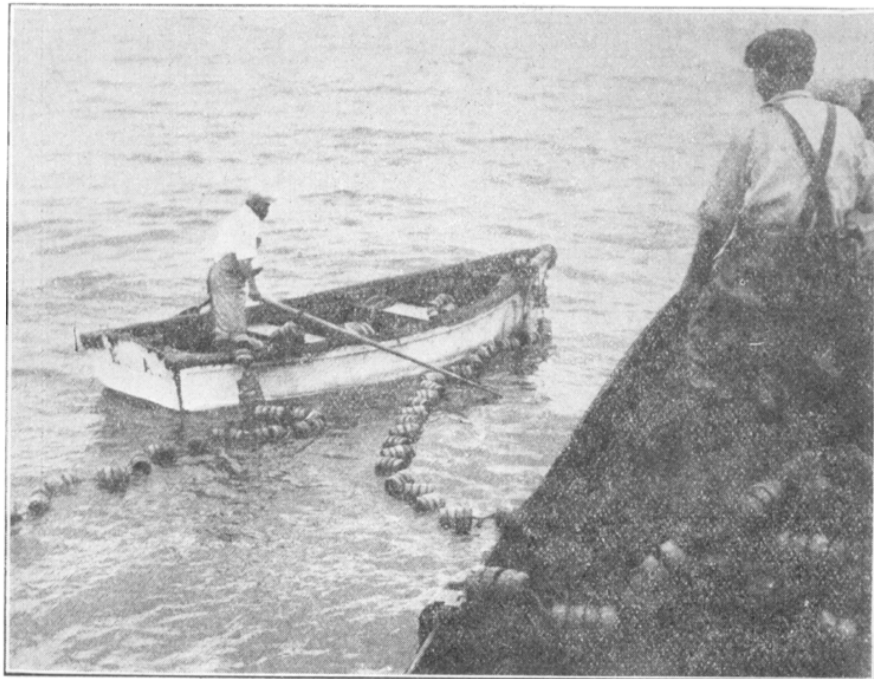


FIG. 22. Bringing the landing bag along side a sardine ring net boat. May, 1929.

FIG. 22. Bringing the landing bag along side a sardine ring net boat. May, 1929

the loss of most or all of the school. When the fish are motionless or are going against the wind, conditions are ideal from the point of view of the fisherman, assuming, of course, that the current is not moving too rapidly in the wrong direction.

5.6. Use of "Scares"

During the hauling of any of the nets here discussed the fish are often milling around looking for a route of escape. The most obvious way

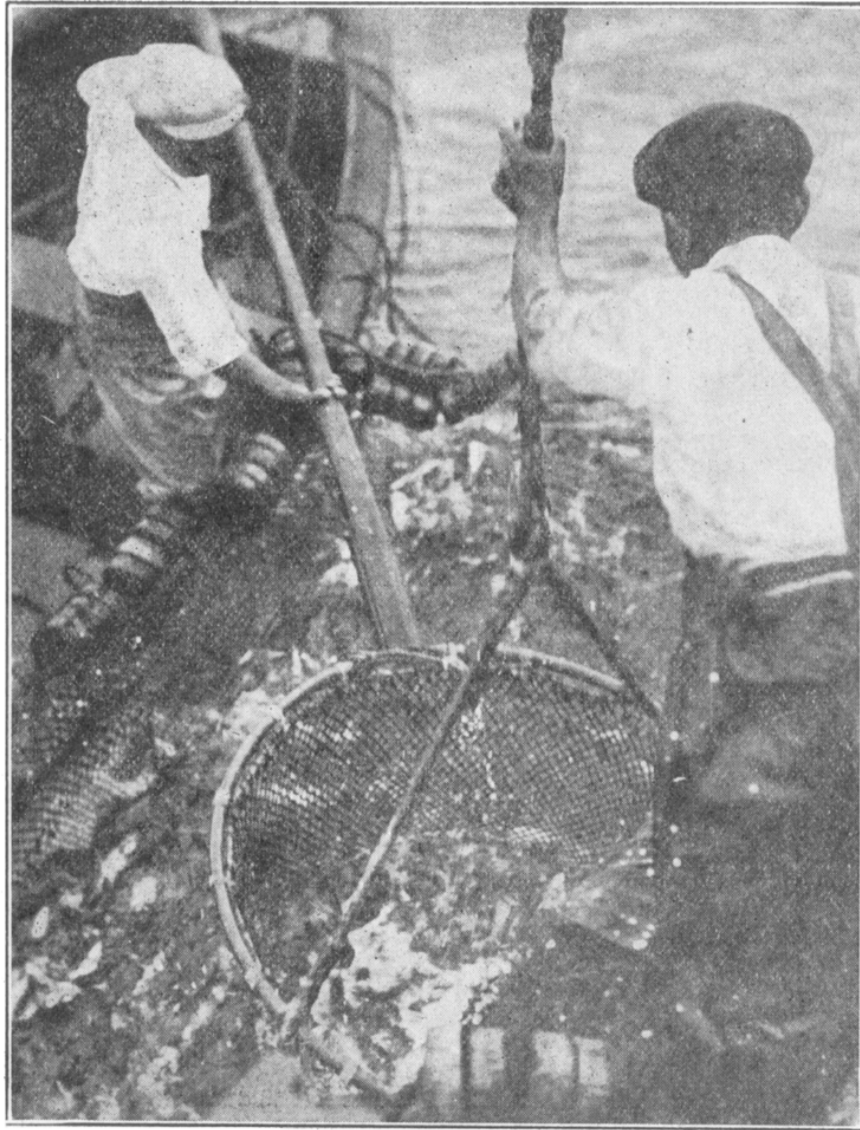


FIG. 23. Brailing out the catch. There are about three tons of sardines in the net. May, 1929.

FIG. 23. Brailing out the catch. There are about three tons of sardines in the net. May, 1929
out is at the gap between the two ends of the net which occurs under the boat. Various "scares" are employed to keep the fish from using this space. A plank or pole repeatedly thrown into the water and retrieved by a light line usually frightens them back, as it gives the appearance of a large fish making a rush through the water. This is especially true at night. A series of paddles on a weighted rope may be jerked up and down under the boat. Rocks thrown into the opening or a sheet of

canvas yanked around on a weighted rope are also effective. These devices were formerly used for both day and night fishing. Sometime during the last part of the 1928–1929 sardine season a new type of scare was tried out. It consisted of an electric light (50- or 75-watt) in a heavy glass housing.¹⁷ When lowered to a depth of 20 to 25 fathoms and blinked on and off the light proved much better than any type of scare that had previously been used. It had the great advantage that it not only kept the fish away from the boat but nearly always kept them from sounding. The new device is now used in many fisheries, has spread clear to Alaska, and at San Pedro has practically displaced all other types of scares for night fishing.

5.7. Brailing

The methods of brailing the catch out of the net and of unloading are much the same for all three types of gear. After most of the net has



FIG. 24. Brailing mackerel out of the net. July, 1929.

FIG. 24. Brailing mackerel out of the net. July, 1929

been hauled in and the fish are in a comparatively small space, one man gets into the skiff, lifts in and fastens the cork line of the center of the brailing piece. On a few small boats which do not use a skiff, the cork line is supported with boat-hooks held by members of the crew. As much of the net as necessary is slid along the side of the boat until the landing bag is opposite the hatch. (Fig. 22.) The webbing is then pulled in until the fish are sufficiently concentrated for brailing. The commonest type of brail consists of a dip net usually about as deep as it is wide, mostly ranging from 2½ to 4 feet in diameter with a handle 8 to 15 feet long. The bottom of the net is open, but is equipped with a light purse line or chain which when pulled tight entirely closes the opening. The brail is suspended from the boom by two or three ropes and is lifted with the winch. When fish are to be dipped, one method is to give the brail handle to the man (or men) in the skiff; he thrusts

¹⁷ A subsequent improvement was the use of a water-tight socket permitting the elimination of the housing.

the net into the writhing mass of fish (fig. 23); the man at the winch lifts it out (fig. 24); part of the crew swings the boom until the brail is over the hatch opening; the man who has been keeping the brail purse line pulled tight, releases it, and the fish drop into the hold. A rope fastened to the brail handle makes it easy for the man in the skiff to recover it. Another system used only for small fish such as sardines is for a man on the boat to thrust the brail into the fish.

A second type of brail used in sardine fishing is gaining popularity among the larger boats. It is similar to the bigger ones of the

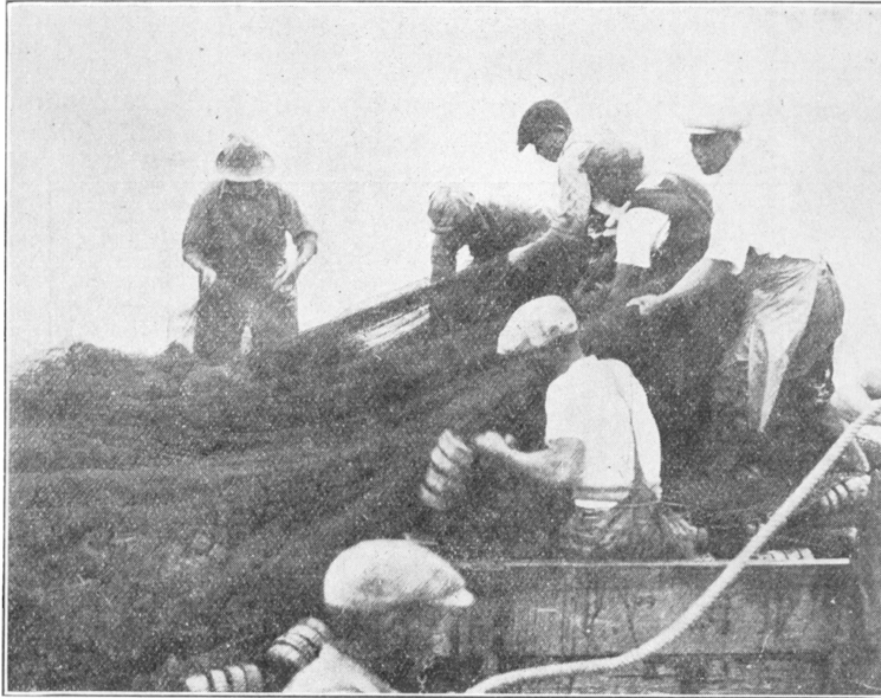


FIG. 25. Repiling a sardine ring net after the haul. May, 1929.

FIG. 25. Repiling a sardine ring net after the haul. May, 1929

type described above, except that it is about 20 to 25 feet deep and does not open at the bottom. Two ropes are used to operate this brail. The hoop is hung from one by a two- or three-point suspension, and the tip of the sack of webbing is attached to the other. Both ropes are carried on the boom and operated by the winch. The handle of the brail is held by men on the boat who move the hoop several feet through the mass of fish. The open end is lifted, swung over the hatch opening and dropped. The other end is then lifted, dumping the fish into the hold. This type of net is much faster than the other, because it will take over a ton of fish at a time. The chief disadvantage is that it cannot be satisfactorily used for unloading, and consequently one of the shallower dip nets must always be carried.

5.8. Unloading

The accompanying description gives the method of unloading sardines and mackerel which has been in use at San Pedro for the past several years. For methods at *Monterey*, W. L. Scofield's report (1929) should be consulted.

When the boat is to be unloaded it is tied to the wharf so that the hatch is directly opposite the entrance of the conveyor which carries the fish into the cannery. A hose is passed into the hold and the fish are flooded to lubricate them. To carry the catch from the boat to the conveyor a chute is used. It is usually about 5 feet long, 2 feet wide where it empties into the conveyor, and 4 feet wide at the other end. The sides are about 12 or 18 inches high. The board across the boat end is usually about 12 inches high but is sometimes left off entirely. The conveyor end is always left open. As a rule such chutes are lined with sheet metal to reduce wear and to make the fish slide more easily. When everything is in place the brail is thrust into the tightly packed mass of fish and unloading begins. (Fig. 26.) After a few brails-full have

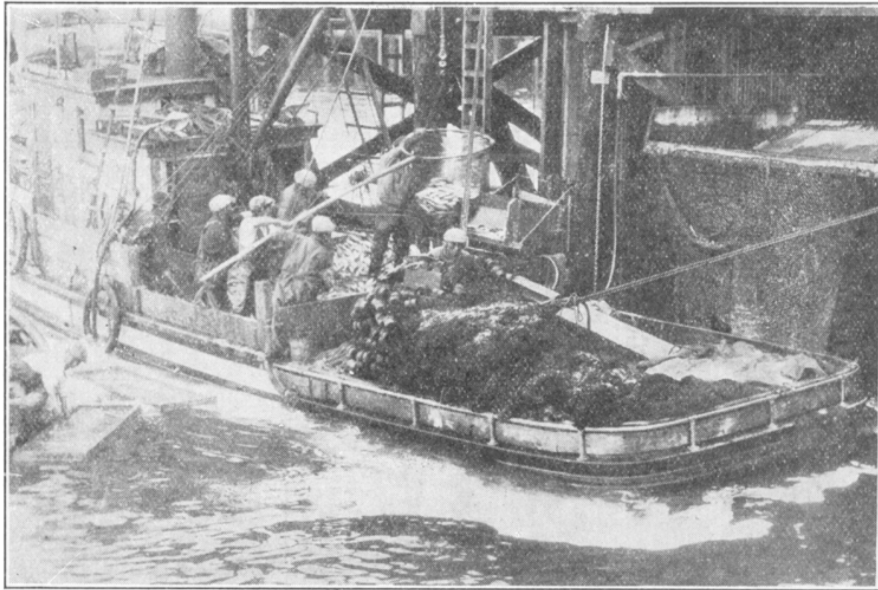


FIG. 26. Ring net boat unloading sardines at a San Pedro cannery. This is a small boat but has lines similar to those of a purse seiner. March, 1929.

FIG. 26. Ring net boat unloading sardines at a San Pedro cannery. This is a small boat but has lines similar to those of a purse seiner. March, 1929

been hoisted out of the hold, a pocket forms in the load of fish. By the use of the stream of water and one or two small dip nets, fish are slid into this pocket and float loosely in the water, making it easy to dip them out. Some small boats have no holds and the fish must be scooped off the deck. When men on a large boat have a deck-load, they usually prefer to sluice and shovel it into the hold as the unloading progresses. The fish are dropped from the brail into the chute from which they slide into a bucket conveyor which lifts them to the top of a tower a little above the second floor level of the canneries. There they are emptied into one of two large weighing buckets with trap bottoms. The buckets, which are suspended from spring scales, are filled until they contain a certain exact weight of fish, such as 400 or 500 pounds. The stream of fish is then diverted into the other bucket and the first is emptied. A flume of water washes the fish into the cannery receiving tanks. For mackerel, some packers use instead of this method a belt

conveyor which carries the fish from the chute directly to the ground floor level of the cannery.

5.9. Care and Preservation of Ring Nets

In addition to the rinsing and salting after each day's fishing, ring nets, like all other tanned nets, must frequently be retanned to keep the fish slime and, to a much less extent, the sea water from rotting the net. It is the opinion of fishermen that to obtain the best results a net which receives daily use should be tanned about every two weeks; though many believe half that often is satisfactory. In sardine fishing, there is an interruption at full moon in any case, so once a month is a convenient interval and probably the one most commonly employed. Some fishermen, however, tan their nets only once every two months.

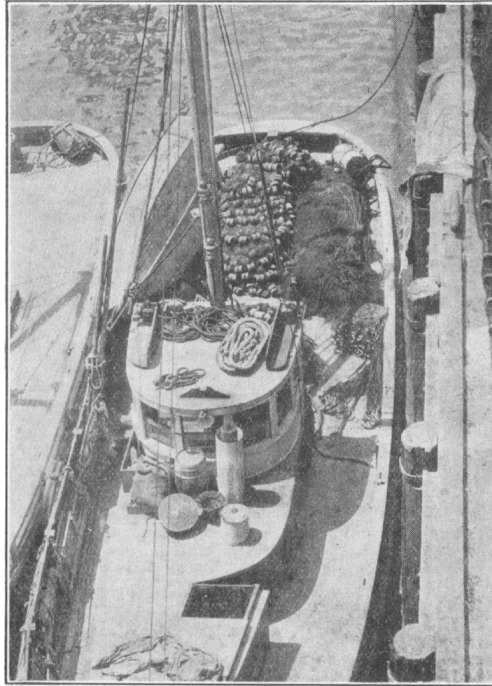


FIG. 27. Monterey ring net boats visiting San Pedro. This shows the Monterey method of piling the net. Note the post in the stern of the left hand boat. This is used for towing a lighter. May, 1930

The process of tanning as carried on at San Pedro consists of boiling tanbark for about two hours in large steam-heated vats owned by the canneries, allowing the liquid to cool a little and steeping the net for several hours. (Fig. 28.) Five or six sacks of bark are required for a mackerel net and eight or ten for a large sardine net. To obtain the best results the net must be spread out and dried before tanning, as a wet net does not properly absorb tanning liquor. When the net is spread out the crew takes advantage of the opportunity and busies itself mending tears and putting in patches.

When the net is to be put away for the season, sometimes it is merely taken off the boat and dried thoroughly. A better treatment is to tan it, rinse it thoroughly and dry it. The net must not be stored away without rinsing out the tanning liquor or the webbing will be "burned" and weakened. Many fishermen remove the cork line and lead line before storing the net, as it is claimed that the rope and corks nearly always

retain enough moisture to rot some of the webbing. Given good care, the wings of a ring net can be expected to last three seasons or even more, and the bag about two seasons, but the brailing piece, which receives the most wear and fish slime, must be renewed every season.

6. THE SUCCESS OF PURSE SEINE AND RING NET AT SAN PEDRO

Both purse seine and ring net are used in many fisheries, but the only real competition between them is in the largest fishery of the state, the sardine industry. This comparison between the two nets therefore deals with them only in their connection with that fishery. The amount of data given is sufficient only to give a bare idea of the relative success of the two kinds of gear. The results *can not* be taken as quantitative.

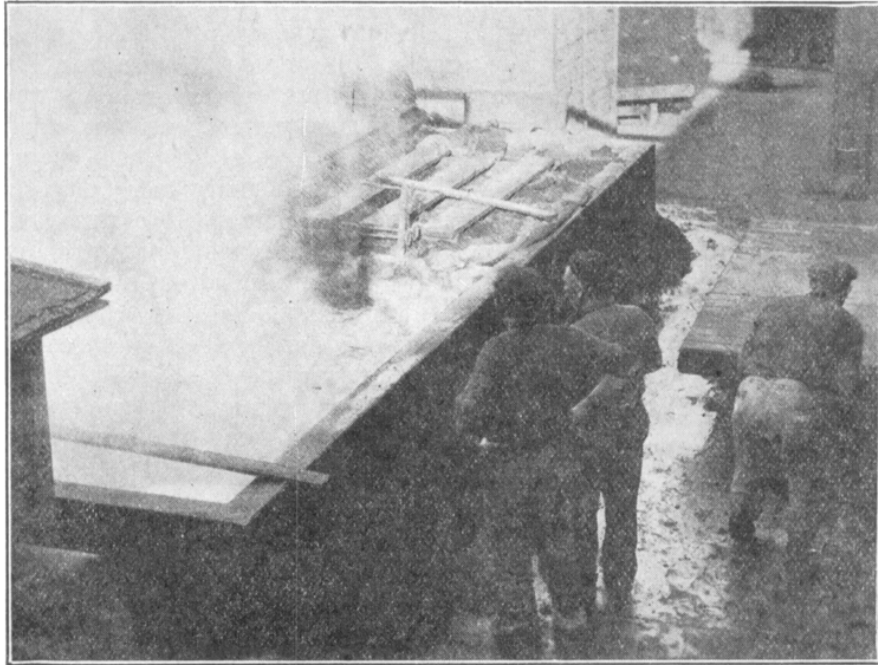


FIG. 28. Tanning a ring net. The tank is divided into two halves. March, 1930.

FIG. 28. Tanning a ring net. The tank is divided into two halves. March, 1930

When an attempt is made to compare the success of two types of fishing gear, there are several important factors which affect the accuracy of the result. Perhaps the greatest of these has to do with the boats which use each form of gear. It would be obviously unfair to make a *gear* comparison using the catches of the lampara boats now employing ring nets and the catches of purse seiners since the purse seiners are able to carry over twice as much fish and have a far greater cruising range. Another factor is the skill and persistence of the fishermen who are using the kinds of gear under comparison. Using a large number of boats helps to create a balance, except when crews of different nationalities are fishing each with its own gear.

In this particular comparison it is easy to eliminate the difficulties which have to do with inequalities in boats. Figures on boats of the purse seine type only need be used since some of these boats are now

fishing with ring nets. It is not so easy to dispose of the difference in nationality. On purse seine *type* of boats (including those using ring nets) the majority of the fishermen are Slavonians and most of the remaining crews are either Japanese or Italian. In general most of the Slavonians have purse seines, while a high percentage of the Japanese and Italians use ring nets. Because of the small number of boats used in this study and the existence of mixed European crews, it was decided for purposes of this paper to divide the crews into Japanese and European only.

The criterion of success taken for this comparison is the number of tons landed during the first two months of the 1929–1930 season. Figures for the previous season could not be used because many of the large boats were just learning to use the ring net and consequently were not very successful. There are two reasons for taking the catches over a long period of time instead of using the more obvious measure of catch per night. First, the short period takes no account of the time the fishermen have to spend ashore working on their nets. Second, and much more important, is the tendency of the purse seiners to pass up the smaller schools. These boats, with their heavy nets, can not afford to spend the time it takes them to catch a six- or eight-ton school of sardines. A ring net outfit, on the other hand, is likely to set for such a school simply because it can haul in half the time. If a purse seiner sees only one or two *small* schools during a night it comes in empty. There is no record of its having fished, and its blank does not enter into the general average. A ring net outfit under the same conditions probably brings in five or ten tons, and consequently its trip is recorded. The only boats used for illustration were those which started fishing in the first few days of the season. Many of them were not ready on the first day, November first, so to give each boat the same starting point, the first several days' catch figures were discarded (*i. e.*, the figures of those catches made before the last boat to start brought in its first catch).

The catches from different canneries were kept separate on account of the difference in the number of days each cannery was open and in the limits¹⁸ each cannery set.

The figures given in tables 6 to 8 were obtained from the catches delivered to three canneries. No other company had more than one ring net outfit fishing sardines for it regularly from the first of the season, with the exception of former lampara boats.

¹⁸ When the boats fishing are likely to bring in more fish than a cannery wants, the cannery usually places a "limit" of a certain number of tons on each boat and refuses to take more than that amount. The limits, of course, are altered to meet different fishing conditions. If the fishing is poor and many boats are bringing in little or no fish the limits are removed and any size load is accepted.

TABLE 6

Cannery No. 1. November 10 to December 31, 1929

Type of net	No.	Size of boat*	Race of crew	Number in crew	Catches	Tons	Tons per catch
Ring.....	1	Large.....	European.....	12	20	1,110	55.5
Ring.....	2	Small.....	European.....	12	16	594	37.1
Ring.....	3	Small.....	European.....	9	15	583	38.9
Ring.....	4	Small.....	European.....	11	19	580	30.5
Averages.....				11	17.5	717	41.0
Purse seine.....	1	Large.....	European.....	10	14	860	61.4
Purse seine.....	2	Large.....	European.....	10	13	788	60.6
Purse seine.....	3	Large.....	European.....	10	12	768	64.0
Purse seine.....	4	Large.....	European.....	10	13	765	58.8
Purse seine.....	5	Large.....	European.....	11	14	697	49.8
Purse seine.....	6	Large.....	European.....	10	11	666	60.5
Purse seine.....	7	Small.....	European.....	10	12	318	26.5
Averages.....				10.1	12.7	695	54.7

*Boats with hold capacities of 70 tons or over are here classed as large. Those with hold capacities of 45 tons or under are classed as small.

TABLE 6

Cannery No. 1. November 10 to December 31, 1929

All of the boats shown in table 6 were manned with about the same type of crew. This likeness eliminates the problem of relative skill as nearly as is possible with such small numbers. The ring net boats were much smaller than the purse seiners. Ring net boat No. 1 is the only large boat using that type of gear, and purse seiner No. 7 is the only small boat in the second group. For the purposes of this discussion, all boats capable of carrying 70 tons or more (of sardines) in the hold are classed as large; those with a hold capacity of 45 tons or less are considered small. Notice that the one large ring net outfit landed much more fish than any of the purse seiners, and that the small ring nets were all higher than the one small purse seine. At this cannery there were limits on only a few nights.

TABLE 7

Cannery No. 2. November 5 to December 31, 1929

Type of net	No.	Size of boat	Race of crew	Number in crew	Catches	Tons	Tons per catch
Ring.....	1	Small.....	Japanese.....	12	25	708	28.3
Ring.....	2	Small.....	Japanese.....	12	30	694	23.1
Ring.....	3	Small.....	Japanese.....	10	20	630	31.5
Ring.....	4	Small.....	Japanese.....	12	19	516	27.2
Averages.....				11.5	23.5	637	27.1
Purse seine.....	1	Small.....	European.....	10	22	758	34.5
Purse seine.....	2	Small.....	European.....	10	24	748	31.2
Purse seine.....	3	Small.....	European.....	10	20	696	34.8
Purse seine.....	4	Large.....	European.....	10	20	643	32.2
Purse seine.....	5	Large.....	European.....	10	20	630	31.5
Purse seine.....	6	Small.....	European.....	9	17	598	35.2
Purse seine.....	7	Intermediate.....	European.....	10	19	550	28.9
Purse seine.....	8	Intermediate.....	Japanese.....	11	20	502	25.1
Purse seine.....	9	Small.....	European.....	9	16	360	22.5
Averages.....				9.9	19.8	609	30.8

TABLE 7

Cannery No. 2. November 5 to December 31, 1929

In this cannery (table 7) the boats were nearly all small; only purse seiners No. 4 and 5 were large. Purse seiners No. 7 and 8 were intermediate in size. The limits placed by this company were sometimes as low as 20 tons, although most of the time they were 30 or 40 tons or were withdrawn. Low limits practically remove any advantage that a large boat may have, and tend to favor the ring nets, which make smaller average catches. The figures show the ring nets to have been slightly more successful. The difference is so slight that it means little.

In this case possible differences between the skill of European and Japanese fishermen enter into the situation since all the ring net boats have Japanese crews, while only one of the purse seiners is operated by Japanese.

TABLE 8
Cannery No. 3. November 7 to December 31, 1929

Type of net	Size of boat	Race of crew	No. in crew	Catches	Tons	Tons per catch
Ring.....	Large.....	European.....	11	18	717	39.8
Purse seine.....	Large.....	Japanese.....	12	20	788	39.4

TABLE 8
Cannery No. 3. November 7 to December 31, 1929

This plant (table 8) had only two boats of the purse seine type fishing steadily. Both were large. of their two nets the purse seine was slightly more successful.

In addition to the differences in the amount of fish brought in by the two kinds of gear there must be taken into account two other factors: the cost of operation of the gear and the number of men needed. Between the ring net and the purse seine these features tend to balance each other. A purse seine costs between \$5,000 and \$6,000, and lasts one or possibly two seasons. A ring net for a large boat costs from \$2,000 to \$3,500 and lasts two or possibly three seasons. The purse seiner is under a two or three thousand dollar per season handicap. The number of men on the crew, on the other hand, is less on the purse seiner. It will be noticed that of the boats shown in the above table, the European ring net outfits have an average of 11 men in the crew, whereas the European purse seiners average 10, a difference of 1 man. of the Japanese crews here given only 2 used purse seines. These 2 boats and 4 others averaged 10.8 men per crew, while the 4 Japanese ring net outfits averaged 11.5 men—a difference of .7 man per crew. Japanese crews have an average of more men than the European outfits chiefly because of the smaller stature of the Japanese; it takes more of them to haul a net of a given size.

Disregarding the size of catches there are two factors to be balanced against each other, one favoring each net. The ring net requires a larger crew to operate it while the purse seine costs more. The question is whether the difference in the cost of the net or the cost of labor will come to the higher figure. Assume that a ring net costs \$2,000 per season less than a purse seine and requires one more man to operate it. If the boat were to catch enough fish to make each fisherman's share \$2,000, the differences in labor and net costs would exactly balance each other. Should it make less than \$2,000 per share, the saving on the price of the net would be greater than the cost of the extra member of the crew.

In these respects, the advantage though slight is on the side of the ring net. Most boats earn less than \$2,000 per share, and the difference in price of net is often greater than \$2,000. of course outfits that are able to operate a ring net successfully with a smaller crew gain a decided financial advantage. Also there are many times when a fisherman is pressed for money and can not afford a purse seine, but may be able to raise the price of a ring net and so have a chance of getting back on his feet.

One argument for the purse seine deals with labor rather than money. Tarred webbing requires less care than tanned, and some fishermen prefer to pay the price of a purse seine simply because of the extra leisure it gives them on shore. Others would rather pay less for their net and spend more time working on it.

To sum up the comparison: The evidence given is not very conclusive. The amount of data is small and the average difference between the two kinds of gear is slight as compared with the differences between individual crews. On the basis of the figures given, the ring net seems to be slightly more successful, but except when original cost is a major consideration, there is no decided advantage for either form of gear.

7. CONCLUSION

Unlike the purse seine and other comparatively standard forms of gear, the ring net is still in a period of development. It was originated in an effort to make the lampara more positive in action, but is gradually losing its lampara features and becoming more and more of a light-weight, high-speed purse seine. Competition with the purse seiners made the lampara fishermen realize the merits of the ring net; while the fact that it was lighter, cheaper, faster and almost as certain as their own gear appealed to the purse seiners. Competition with, and use by, purse seine fishermen has resulted in a continuous effort to make the ring net surer of its catch. Bags are being made larger and wings shorter; more corks and leads are being added; and where necessary, parts of the net are being strengthened to enable heavier loads to be handled. Talk to almost any ring net fisherman at the close of a season, and you will hear, "Last season my net was like this . . . Next season, I am going to make these changes . . ."

8. SUMMARY

I. History—

1. The first gear used for taking large quantities of sardines in California was a hand-operated purse seine, first used in 1893.
2. Lamparas were introduced from the Mediterranean in 1905 and shortly after 1915 had entirely displaced sardine purse seines.
3. Attempted improvements on the lampara resulted in the ring net, which was slow in gaining popularity.
4. In 1925 machine-operated purse seines, perfected in other fisheries, entered the sardine business.
5. The lampara fishermen, threatened with loss of business, adopted the ring net.
6. Some purse seine fishermen began using the ring net. —
7. Ring nets entered the mackerel fishery in southern California as a result of the great canning activity which started in 1928.

8. Ring nets are now used in other fisheries. —
 9. Some boats are now using purse seines for tuna and ring nets for sardine fishing. —
- II. Structure of ring nets—
1. Ring nets are made of tanned webbing and consist of three parts: a central bag of fine mesh, and two end portions or wings of coarse webbing. The relative proportion of these parts vary greatly.
 2. Purse rings now extend all, or almost all, around the bottom of the net. —
 3. Most San Pedro sardine ring nets are from 150 to 250 fathoms long by 25 to 40 fathoms deep. Monterey nets are from 110 to about 190 fathoms long and from 25 to 35 fathoms deep.
 4. Bags of sardine nets are customarily of 1- to 1 ½-inch mesh. Most long wings are made from 3 sizes of webbing: 4-, 6- and 8-inch mesh. Short wings commonly consist of only 1 size mesh, usually 8- or 10-inch.
 5. At San Pedro the mackerel and sardine nets used by the same boat may be the same length, or the mackerel net may be the shorter, (There are no mackerel ring nets at Monterey.)
 6. Bags of mackerel ring nets are of 2-inch mesh. The wings are much like those of sardine nets.
 7. Mackerel ring nets are used to some extent for barracuda and other fresh fish market-species.
 8. Tuna ring nets are larger and much heavier than sardine or mackerel nets. —
- III. Boats using ring nets—
1. Purse seine boats using ring nets range from 55 to 80 feet long and are able to carry—from 60 to 140 or more tons of fish. Small boats of the purse seine type are more satisfactory with ring nets.
 2. Southern California ring net boats are from 35 to 60 feet long and can carry from 7 to 50 tons. In general those which can carry over 20 tons engage in fishing for the canneries and the smaller ones for the markets.
 3. Northern ring net boats are from 30 to 50 feet long. At Monterey they tow lighters of a capacity to 70 tons when fishing for sardines. At San Francisco fish are carried on deck. Southern California type ring net boats are also used in the north.
 4. At San Pedro the sardine fishery is essentially one of purse seine type boats, while the mackerel fishery is one of small boats.
 5. Purse seine type boats using ring nets for sardines averaged smaller in size in 1929–1930 than in 1928–1929. The reverse is true of those using purse seines.
- IV. Operation of purse seines, lamparas and ring nets—
1. Purse seines are pursed and then hauled from one end over the side of the boat and onto the turntable.
 2. San Pedro sardine lamparas were hauled from both ends over the stern. —
 3. San Pedro ring nets are pursed while being hauled from both ends over the stern of the boat.

4. Monterey ring nets are hauled over the side. Nearly all Monterey nets are pursed shut before hauling is begun. Most of them are hauled from both ends, some from one.
 5. Nets must be circled so that the fine webbing is across the path of moving fish and must be so placed that wind or current will not blow the boat into its net or pull the circle badly out of shape.
 6. Scares such as poles, paddles, rocks, or a blinking electric light must often be used while hauling or pursing.
 7. Fish are dipped out of the net with a power-operated dip net. —
 8. Cannery fish are unloaded at San Pedro by brailing the catch on to bucket or belt conveyors.
- V. .
In the sardine industry a comparison of the success of the ring net and the purse seine over a two months' period shows the ring net to have been slightly more successful.
- VI. .
Ring nets are still in a period of comparatively rapid evolution. —

9. MOST RECENT DEVELOPMENTS

Since the completion of this bulletin, the following important developments have taken place:

1. Some of the San Francisco sardine fishermen are now using ring nets (1930–1931 season).
2. Late in September, 1930, ring net outfits at San Pedro started night fishing for mackerel. The new method seems successful. The use of chum is done away with and very large hauls (up to 50 tons) are often made.

10. BIBLIOGRAPHY

- California Fish and Game. 1919. New Fish Net. California Fish and Game, vol. 5, no. 1, p. 41.
- Collins, J. W. 1892. Report on the Fisheries of the Pacific Coast of the United States. Report, U. S. Commission of Fish and Fisheries, for 1888, p. 158.
- Higgins, Elmer, and Holmes, Harlan B. 1921. Methods of Sardine Fishing in Southern California. California Fish and Game, vol. 7, no. 4, pp. 219–237.
- Phillips, J. B. 1930. Success of the Purse Seine Boat in the Sardine Fishery at Monterey, California (1929–1930 Fishing Season). California Division of Fish and Game, Fish Bulletin no. 23.
- Scofield, W. L. 1926. Purse Seines for California Sardines. California Fish and Game, vol. 12, no. 1, pp. 16–19.
1929. Sardine Fishing Methods at Monterey, California, California Division of Fish and Game, Fish Bulletin no. 19.
- Skogsberg, Tage. 1925. Preliminary Investigation of the Purse Seine Industry of Southern California. California Fish and Game Commission, Fish Bulletin no. 9.
- Smith, Hugh M. 1895. Notes on a Reconnoissance of the Fisheries of the Pacific Coast of the United States in 1894. Bulletin, U. S. Fish Commission, for 1894, vol. 14, pp. 227–231.

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Descriptions of purse seines are to be had in the publication by Skogsberg (1925, pp. 88-95) and in Phillips' report (1930).