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Publication Date

1930-04-01

**STATE OF CALIFORNIA
DIVISION OF FISH AND GAME
FISH BULLETIN No. 23**

Success of the Purse Seine Boat in the Sardine Fishery at Monterey, California (1929–1930 Fishing Season)



By
J. B. PHILLIPS



FIG. 1. Purse seine boats waiting to unload sardines into the hopper of a suction pump at a Monterey cannery. Cables and hoist house of the cannery are shown at the right. Photograph by J. B. Phillips, December, 1929.

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By J. B. PHILLIPS

1. BOATS AND GEAR

The 1929–1930 sardine² season at Monterey, which started on August 1, 1929, and ended February 15, 1930, found an influx of purse seine boats to supply sardines for the canneries. The lampara boat replaced the purse seine boat in this fishery in 1905, and until the fall of 1929 it had a virtual monopoly on the delivery of sardines to the Monterey canneries. At the close of the first season of the purse seine "comeback," it was deemed advisable to present the Monterey catch statistics for the 1929–1930 sardine season so that a comparison could be made of the success of the two types of fishing boats.

It may be well at this time to give a brief history of the purse seine at Monterey. According to W. L. Scofield,³ the taking of sardines at Monterey in any quantities began in 1903 with the establishment of a sardine packing plant. From 1903 to 1906, purse seines were used (gill nets were used for obtaining small quantities for bait). In 1905, the lampara was introduced on the Pacific coast at Monterey, displacing the purse seine,⁴ one or two of which continued in use until about 1915. No purse seines were in operation at Monterey from about 1915 until 1926, at which time K. Hovden obtained the services of two for his cannery. From 1926 until the end of the 1928–1929 season, K. Hovden had two purse seines operating. At the start of the second month (September first) of the 1929–1930 season, there were 16 purse seine boats delivering sardines at the Monterey canneries, this number increasing to 28 in December, 1929.

² The California sardine (*Sardina caerulea*).

³ Scofield, W. L. Sardine fishing methods at Monterey, California. California Division of Fish and Game, Fish Bulletin No. 19, pp. 25–26, 1929.

Although there was a decided increase in the number of purse seine boats this season, it was not at all unexpected. During previous seasons, there had been a period of scarcity in Monterey Bay, which usually comes between the middle of October and the middle of January. Though sardines in sufficient quantities to warrant operation are lacking within the bay at this time, they have been found to the northward,⁵ this year as far as Point Reyes (115 miles north of Monterey), in abundant quantities. Due to the small size of the lampara launches and the necessity of towing a lighter for carrying their catches, they

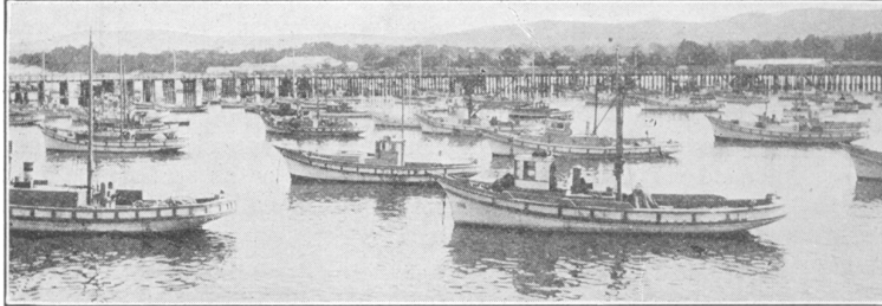


FIG. 2. A group of lampara launches at anchor in Monterey harbor. The spar-studded horizon here shown is in noticeable contrast to previous seasons. Note the clipper bow and flaring gunwales of the "Monterey style" of boat. Photograph by J. B. Phillips, April, 1930.

FIG. 2. A group of lampara launches at anchor in Monterey harbor. The spar-studded Horizon here shown is in noticeable contrast to previous seasons. Note the clipper bow and flaring gunwales of the "Monterey style" of boat. Photograph by J. B. Phillips, April, 1930

do not make many trips outside of Monterey Bay except when the ocean is fairly calm.

In judging the success of the purse seine boat it must be borne in mind that the 1929–1930 season was a transitional period regarding the type of gear used. Not only was there a decided influx of purse seine boats, but during this period there was also a radical change in the nets used by the lampara or round haul boats. The lampara net, which had dominated the Monterey sardine fishery since it first made its appearance in 1905, was abandoned in favor of the so-called ring net,⁶ a distinctly different type resembling a purse seine. (The lampara is still used in capturing small quantities of sardines, squid and anchovies for the Monterey markets.) Along with the change to ring nets, a winch and boom were added to the lampara launch to accelerate pursing and facilitate unloading, so that not only was the efficiency of the lampara boat increased but labor greatly reduced as well. However, the cruising radius of this type of boat remained the same, and this was the main reason that the invasion of the purse seine type of boat was successful.

A brief description of the three types of nets that have played parts in the commercial sardine fishery of Monterey follows. More detailed accounts can be had from the references given.

⁵ In the Monterey region, no fishing for sardines is carried on south of Monterey Bay (Point Pinos) due to unfavorable currents present.

⁶ Other terms commonly used to designate this type of net are: *half-ring* and *semi-purse*. The term *purse lampara* may be occasionally used also, although this name was specifically applied to an experimental lampara net with purse rings. The term *half-ring* was applied to a net having purse rings along only a portion of the lead line, usually just the length of the bag.

1.1. Description of the Purse Seine

The purse seine¹ is built like a long shallow curtain without any bag in the middle. Its upper edge is buoyed with numerous corks on a strong rope, a cork line, to keep the seine floating at the surface of the water. The lower edge of the seine is weighted with leads strung along a light rope, called the lead line. The lead line is about 10 per cent shorter than the cork line, which allows the net to be pursed quickly and bags the bottom strips of the seine. Uniformly distributed along the entire length of the lead line are a great number of rings which are attached to the lead line by short ropes. Through these rings runs the purse rope, by means of which the bottom of the net is closed. At both ends of the net are the up and down lines, between the cork and lead lines. Along each of the up and down lines is a series of small rings through which runs the brail rope. The brail line is used to lift up the lead line to the cork line, one end of it being fastened to the lead line, the other end to the cork line, where the cork line is prolonged for attachment to the skiff or boat.

The purse seines used at Monterey are 200 to 230 fathoms long and 25 to 30 fathoms deep. The mesh is nearly all $1\frac{3}{4}$ and 5 inches. The 5-inch mesh is used as selvage attaching the main body of the net to the cork line, lead line and up and down ropes. The amount of selvage varies from a few meshes deep along the cork line to possibly 75 meshes deep along the lead line and the up and down lines. The main body of the net is of $1\frac{3}{4}$ -inch mesh. The 5-inch mesh is usually of 36- and 42-

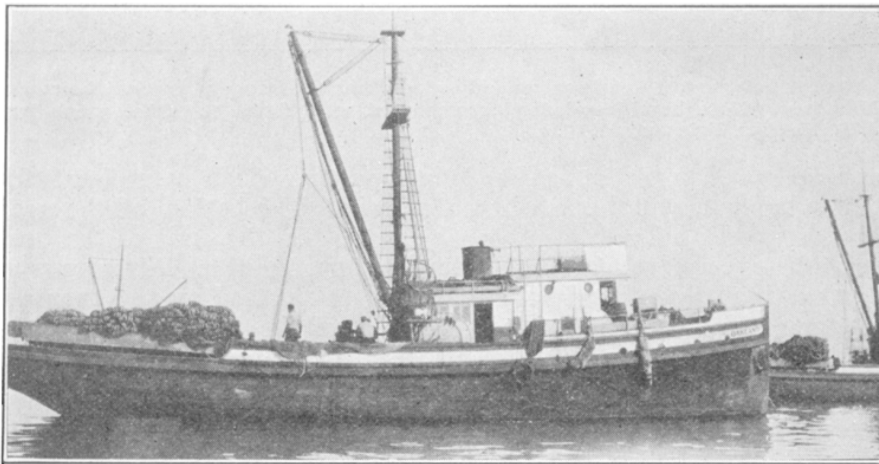


FIG. 3. One of the larger purse seine type of boats at Monterey during the 1929-1930 fishing season. The purse seine vessels are equipped so that the crew lives on board, whereas the lampara men live ashore. Photograph by J. B. Phillips, January, 1930.

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thread, while the $1\frac{3}{4}$ -inch mesh is 12-thread at the top portion of the net and 9-thread on the bottom portion. The purse rings are made of iron and either 5- or 6-inch diameter. They are attached to the lead

line by short ropes, the rings being spaced about 2 fathoms. The up and down rings are also of iron and usually of 2-inch diameter, and are attached direct to the up and down line.

The purse seine is piled on the turntable in the stern of the purse seine boat with the corks on one side and the leads on the other. One end of the net is attached to the large skiff. When fish are to be surrounded, the skiff is cast loose and the purse seine boat circles at

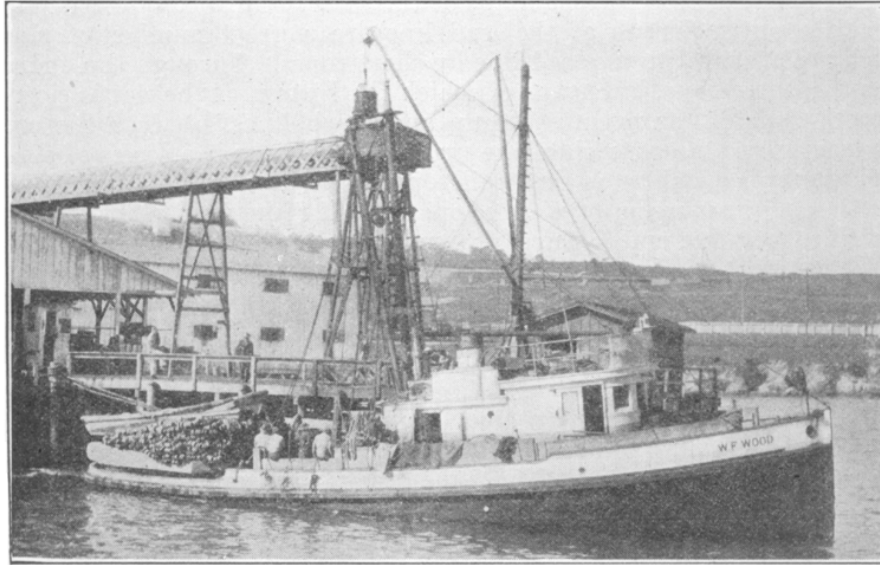


FIG. 4. A purse seine boat unloading sardines at the only vertical hoist at Monterey. Note how deep-laden as compared with figure 3. Photograph by J. B. Phillips, February, 1930.

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decreased speed until the net is all out and the skiff is overtaken. The net now hangs about the fish like a curtain. The bottom of the net is then closed with all possible speed by reeling in the ends of the purse ropes on the power winch, thereby impounding the fish. After pursing, the net is hauled by hand from one end and placed on the turntable until the catch is concentrated in the bunt of the other end. The fish are then transferred to the hold of the boat by means of a large dip net.

1.2. Purse Seine Boats

The purse seine boats (see fig. 3) at Monterey during the 1929–1930 season varied from 55 to 85 feet in length. Except for two gasoline boats that were destroyed by fire, all were equipped with diesel engines ranging from 90 to 250 horsepower. The hold capacities varied from 35 to 130 tons, the average being close to 80 tons. The crew usually numbered 10 men, including the captain.

1.3. Description of the Ring Net

The ring net⁸ which was adopted by all the lampara crews during the 1929–1930 season in preference to the lampara net, resembles a purse

⁸ A detailed account of the ring net at San Pedro, with a comparative mention of the Monterey ring net, by D. H. Fry, Jr., of the staff of the California State Fisheries Laboratory, will soon be published as a Fish Bulletin of the Division of Fish and Game of California.

seine essentially. It differs from a purse seine, in the main, by the rounded ends and the lighter twine used in the webbing. The ring net is practically rectangular in outline, excepting for the rounded ends starting from 4 to 12 fathoms from the end, the cork and lead lines uniting in a pull rope. It is suspended in the water in a curtain-like manner by means of numerous corks along the cork line. There are also iron rings uniformly suspended along the lead line, of about the same size and spacing as in the purse seine, through which the purse rope runs and by means of which the net is pursued. The net is composed of two wings and a main body, the latter of which has a landing bag at either the center or at one end. The landing bag is simply of heavier twine and is the portion of the net into which the catch is concentrated preparatory to brailing. The size of the ring nets used by the lampara crews at Monterey varied from 125 to 175 fathoms in length and 25 to 35 fathoms in depth. Except for the wings which are from 4 to 12 fathoms in length, the net is composed of $\frac{1}{4}$ -inch mesh and of 6-thread. The landing bag is usually of 9-thread. The mesh of the wings varies from 4 to 12 inches (occasionally 16 inches) and is commonly of 6-thread.

The outstanding feature of the ring net is the speed with which it can be operated. A ring net crew can make two or three hauls while a purse seine crew is making one.

When fish are sighted, the lighter with one end of the net attached to it is cast loose, the net being pulled off the stern of the launch by the weight of the lighter. The circle is completed at high speed, and the net pursued quickly by means of the power-driven winch. The net is then drawn in by hand⁹ until the catch is crowded into the landing bag,

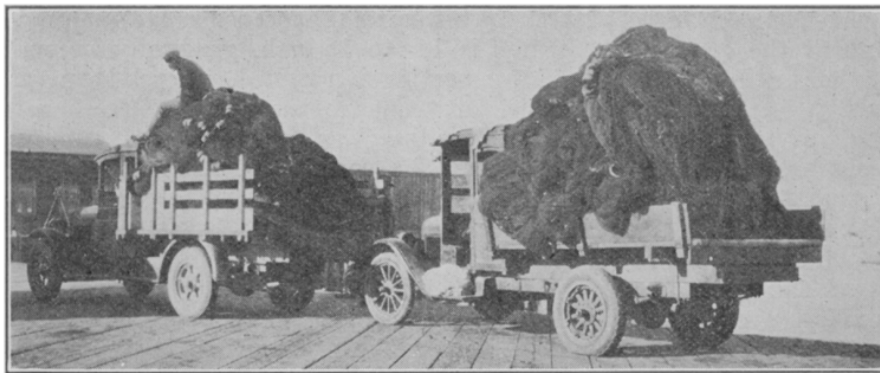


FIG. 5. Ring nets used by lampara launches. These nets are loaded on trucks and taken for tanning and drying, preferably every two weeks. Whereas the charge for trucking a lampara net was \$2.00 (1929), the charge for a ring net was \$5. The greater bulk of the ring net is due chiefly to its greater area of small-meshed webbing. Photograph by J. B. Phillips, December, 1929.

FIG. 5. Ring nets used by lampara launches. These nets are loaded on trucks and taken for tanning and drying, preferably every two weeks. Whereas the charge for trucking a lampara net was \$2.00 (1929), the charge for a ring net was \$5. The greater bulk of the ring net is due chiefly to its greater area of small-meshed webbing. Photograph by J. B. Phillips, December, 1929

from where it is brailed into the lighter by means of a power-operated dip net.

A ring net crew consists of 8 to 13 men. Eleven men can handle readily the more popular type of ring net having the landing bag in the middle, although some of the captains retained the same number

⁹ If the landing bag is in the middle, both ends are drawn in at the same time; if the landing bag is at one end, all hands concentrate on pulling in the long end.

of men that they had signed on when still using the lampara net. In the few cases where the landing bag is at one end of the net, 8 men are enough for operating purposes.

1.4. Ring Nets Used by Purse Seine Boats

The ring nets used by purse seine boats at Monterey (1929–1930 season) are essentially the same as those used by the lampara boats except that they are longer, varying from 175 to 200 fathoms, and that some may have slightly heavier twine throughout. They are operated in the same manner. The turntable is removed and the net piled on the stern of the boat in the same fashion as on the lampara boat. As they do not tow lighters, one end of the net is attached to the large skiff which is cast loose when sardines are sighted.

The crew is made up of the same number of men as a purse seine crew.

1.5. Description of the Lampara or Round Haul Net

The lampara¹⁰ or round haul net is suspended in the water in the usual manner by a cork line at the top and a lead line at the bottom. The net is very shallow at both ends, gradually deepening toward the center or bag portion. When the ends of the net are hauled on, this deeper central portion of the net forms a deep pocket. This net has no rings, the success of the net depending upon the speed with which the deep pocket is brought into a position that prevents escape of the fish. The large mesh of the wings allows the net to be closed more quickly and at the same time serves to scare the fish back into the bag. However, the fish have the opportunity of diving under the lead line unless the net is pulled in very swiftly; this being the main disadvantage. The mesh at the ends of the wings is 14- to 16-inch, gradually becoming smaller until the central or bag portion is reached, where the mesh is usually $\frac{3}{4}$ - to 1-inch. The size of twine varies from 6-thread in the wings to 6- and 9-thread in the landing bag. The typical lampara or round haul net at Monterey (1929–1930 season) was 160 to 200 fathoms long and 18 to 35 fathoms deep at the bag.

A lampara outfit consists of a launch, and a lighter towed behind the launch into which the catch is loaded. During the 1929–1930 season the average launch was about 45 feet in length. All of the launches, except for 8 or 10 that were equipped with diesel engines of 40 to 65 horsepower, were equipped with 30- or 40-horsepower gas engines. The average lighter capacity was around 50 tons, the individual lighters ranging from 35 to 70 tons. A lampara crew is comprised of 11 to 14 men.

When sardines are observed by the luminescence they cause in the water, the lighter with one end of the net attached to it, is cast loose. The launch circles at moderate speed so that the net can be paid out properly. After the net has been paid out and the lighter reached again, the net is hauled in quickly from both ends until the catch is

centered in the bag. The unloading is accomplished by means of a large dip net manipulated by hand.

2. PRESENTATION OF DATA BASED ON TOTAL CATCH

The following data are based on the total number of boats fishing throughout the season, the data on a number of representative boats being given later. In presenting the following data, the cruising radius of a boat is considered of prime importance. No distinction is made

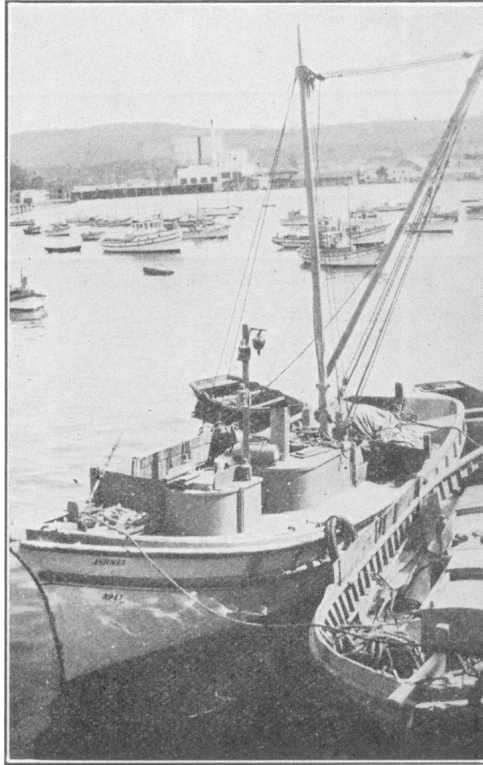


FIG. 6. Lampara launch (the net has been removed). Note the mast and boom which are now typical of the lampara launches at Monterey. The boom is used as an aid to scooping fish and was adopted along with the change to ring nets. At the same time, a small drum winch, driven by the boat engine, was installed for pursuing the ring nets. Photograph by J. B. Phillips, April, 1930

between nets as the lampara crews changed to ring nets at varying times throughout the season, and also a few of the purse seine boats used ring nets. Perhaps after the 1930–1931 season, the new nets having become permanent, an accurate comparison can be made of the relative efficiency of the purse seine and the ring net. As far as the two types of nets are concerned, good arguments can be found favoring each type. In the ensuing tables and figures, the term *purse seine boat*

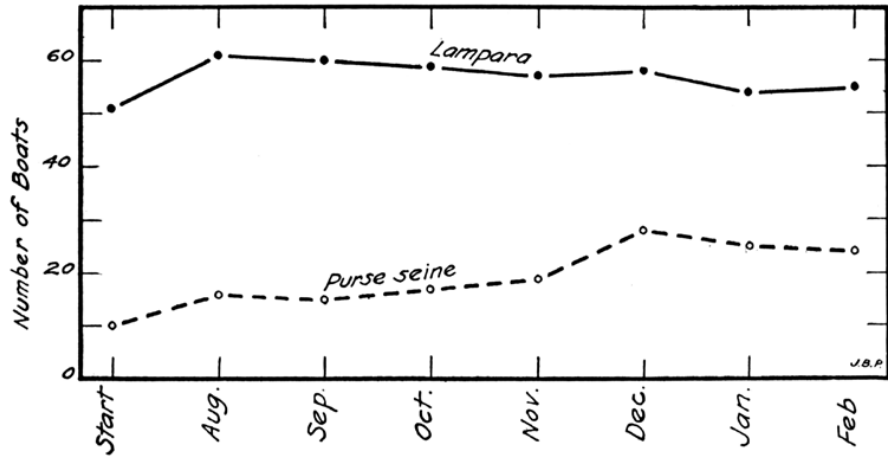


FIG. 7. Number of boats of each type delivering at Monterey sardine canneries during the 1929-1930 season.

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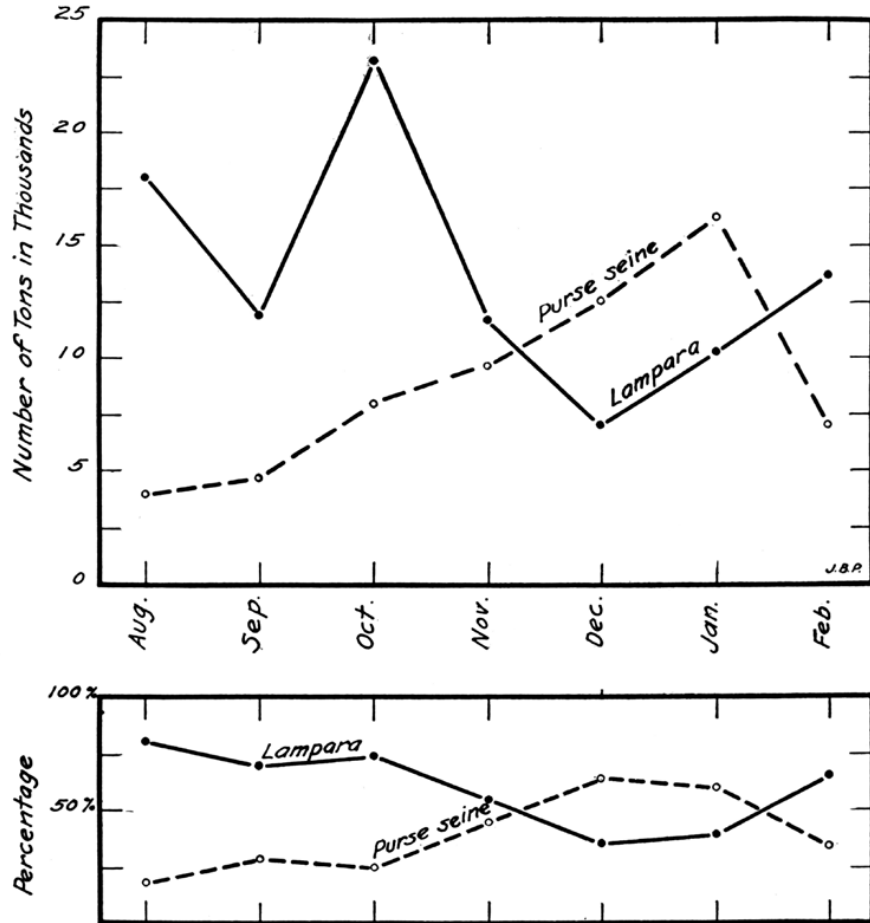


FIG. 8. Total monthly sardine tonnage delivered by the two types of boats.

FIG. 8. Total monthly sardine tonnage delivered by the two types of boats

is used to designate a boat that has a hold on board into which the catch is loaded habitually; the term *lampara boat* refers to the smaller boat or launch which tows a lighter or scow into which the catch is loaded. All the following data are assembled in monthly periods. It was found that the graphic representation was much clearer when so grouped. The daily fluctuations were too irregular and confusing; weekly fluctuations, although steadier than daily, were also more confusing than the monthly. No doubt the reason that the monthly period is more uniform and indicative is that the idleness due to the full moon, storms, or lay-offs, is dispersed over a greater number of days.

All the data in the following tables were obtained from the receipts that the cannery are required to make out on regular forms furnished by the Division of Fish and Game of California. These receipts are made out in triplicate—one copy goes to the party making delivery, one copy is retained by the cannery, the third copy is collected by the Division of Fish and Game. (This third copy is pink in color, hence the term *pink ticket*.) From the *pink ticket* the author tabulated the catch of each boat. The catches of the two types of boats were then segregated and the data worked up into the following tables.

Table I is presented to give an idea of the number of boats of the purse seine type, and of the lampara type; also the number of boats using the various types of nets at different times throughout the 1929–1930 sardine season at Monterey. This table is based upon deliveries of fish. One week leeway is allowed because of the irregular arrival of purse seine boats. For example, a boat that commenced delivering on the 28th, would not be classified as having delivered throughout that month. Figure 7 represents only the number of boats of the two types, *i.e.*, the first two columns of the table.

TABLE I
Number of Boats and Kind of Gear

	Purse seine boats	Lampara boats	Purse seine boats using purse seines	Purse seine boats using ring nets	Lampara boats using lamparas	Lampara boats using ring nets
Start season.....	10	51	8	2	49	2
Month of August.....	16	61	13	3	57	4
Month of September.....	15	60	13	2	31	29
Month of October.....	17	59	14	3	13	46
Month of November.....	19	57	15	4	1	56
Month of December.....	28	58	24	4	1	47
Month of January.....	25	54	22	3	0	54
Month of February.....	24	55	21	3	0	55

TABLE I
Number of Boats and Kind of Gear

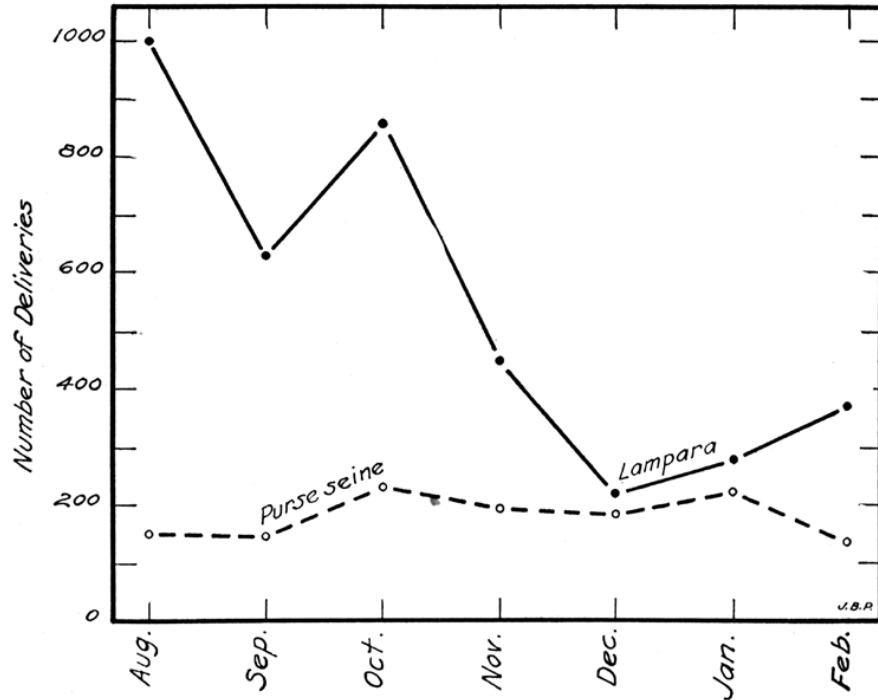


FIG. 9. Total number of deliveries made each month by the two types of boats.

FIG. 9. Total number of deliveries made each month by the two types of boats

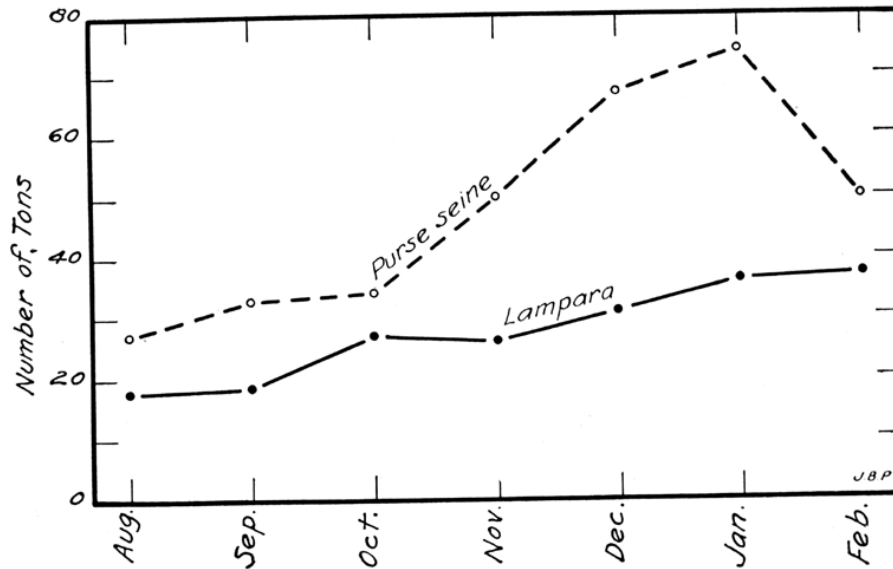


FIG. 10. Number of tons per delivery of the two types of boats for each month.

FIG. 10. Number of tons per delivery of the two types of boats for each month

Table II gives the total monthly and seasonal tonnage delivered by all the purse seine boats and all the lampara boats, together with the percentages that the totals represent. (See fig. 8.)

TABLE II
Tons Delivered

Month	Actual tonnage			Per cent of tonnage		
	Lampara boats	Purse seine boats	Total	Lampara boats	Purse seine boats	Total
August.....	18,084	4,233	22,316	81	19	100
September.....	11,980	4,885	16,865	71	29	100
October.....	23,305	8,112	31,417	74	26	100
November.....	11,768	9,706	21,474	55	45	100
December.....	7,102	12,631	19,733	36	64	100
January.....	10,277	16,333	26,610	39	61	100
February.....	13,839	7,012	20,851	66	34	100
Season.....	96,354	62,912	159,267	60	40	100

TABLE II
Tons Delivered

The total number of deliveries made by the two types of boats is represented in Table III and figure 9. Table IV (see fig. 10) is derived from tables II and III, and gives the average tons per delivery of the two types of boats, based on the total number of boats during the season.

TABLE III

TABLE IV

Month	Number of deliveries		Month	Average tons per delivery	
	Lampara	Purse seine		Lampara	Purse seine
August.....	1,000	156	August.....	18	27
September.....	636	149	September.....	19	33
October.....	859	236	October.....	27	34
November.....	450	194	November.....	26	50
December.....	224	188	December.....	31	67
January.....	283	222	January.....	36	74
February.....	375	139	February.....	37	50
Season.....	3,827	1,284	Season.....	25	49

TABLE III and IV

Figure 11 pictures (in 5-ton units) the number of boats of each type at various capacities. In the case of the lampara boat, the capacity of the lighter or barge is referred to, and of the purse seine boat the capacity of the hold. On days when there were no limits, boats of both types would sometimes come in with "deck loads." Roughly, the deck of a boat of either type would accommodate an additional one-third. The average lampara lighter during the 1929-1930 season had a capacity of approximately 50 tons, while the average purse seine hold was approximately 80 tons.

Before discussing the data presented, it may be of value to furnish the following table of information pertaining to the canneries operating on Monterey sardines during the 1929-1930 season. The starting and ending dates refer to the deliveries of fish; the heading, *Fish pump, purse seine*, indicates the date that installation of a suction pump was completed, whereby a plant was ready to unload purse seine boats. (One plant was able to unload purse seine boats by means of a vertical bucket hoist. All other plants had inclined cable hoists.)

TABLE V

Name of plant	Started season	Fish pump, purse seine	Ended season
Booth.....	Aug. 1	Hoisted purse seine fish, December 23.....	Feb. 11
Gross.....	Aug. 1	At start.....	Feb. 9
San Xavier.....	Aug. 1	August 24.....	Feb. 9
California.....	Aug. 1	October 2.....	Feb. 9
Carmel.....	Aug. 1	(No purse seine).....	Feb. 10
Monterey.....	Aug. 1	(No purse seine).....	Feb. 12
Bayside (flour).....	Aug. 1	Used Del Mar's.....	Feb. 11
Sea Pride.....	Aug. 1	(No purse seine).....	Feb. 11
Hovden.....	Aug. 1	At start.....	Feb. 11
San Carlos.....	Aug. 3	October 24.....	Feb. 8
Del Mar.....	Aug. 6	At start.....	Feb. 10
Vegetable Oil.....	Sept. 2	Used Hovden's until own ready, November 24.....	Jan. 23
Custom House*.....	Sept. 2	At start.....	Feb. 8
Monterey Sardine Products*.....	Oct. 22	December 22.....	Jan. 31
Globe Oil*.....	Dec. 21	Used San Carlos'.....	Feb. 11

* Plants operating for first time.

TABLE V

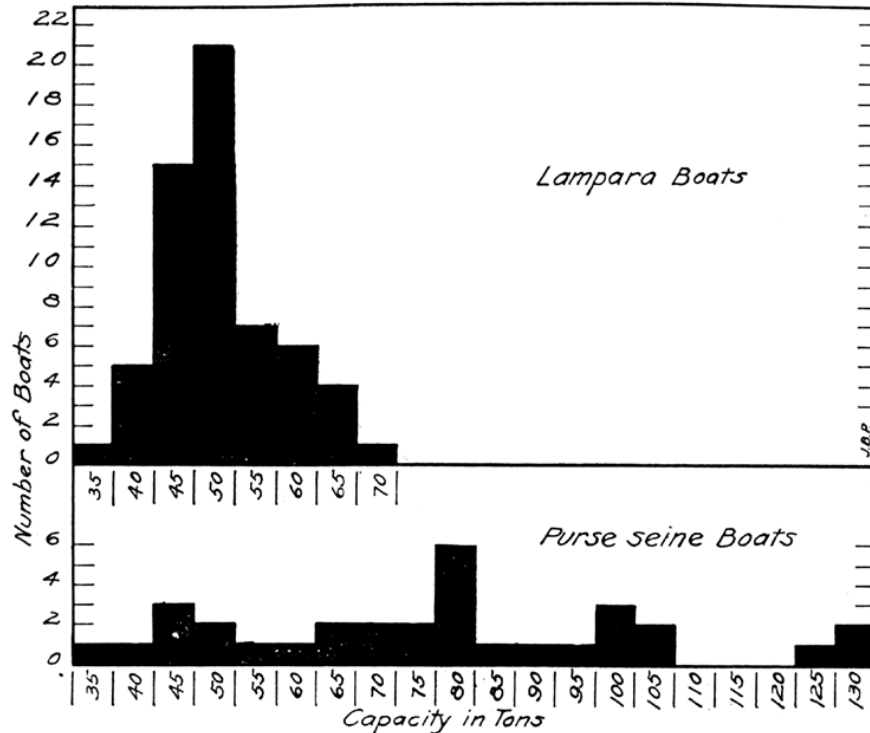


FIG. 11. Number of different capacity boats of each type.

FIG. 11. Number of different capacity boats of each type

3. DISCUSSION OF DATA BASED ON TOTAL CATCH

By table I and figure 7, it will be noted that the number of boats of the purse seine type increased as the season progressed. When the season opened, there were only a few plants prepared to unload purse seine boats. These boats could not unload by means of the inclined cable hoists¹¹ due to the shallow water and the construction of these larger boats. It was therefore necessary either to extend wharfs out into

¹¹ For a complete description of cable hoists at Monterey, see the publication by W. L. Scofield, "Sardine fishing methods at Monterey, California." California Division of Fish and Game, Fish Bulletin No. 19, pp. 45-47, 1929.

deeper water and allow the purse seine boats to unload alongside the conveyors, or to install suction pumps.¹² Due to the location of most of the canneries at Monterey, it was found more practical to install suction pumps and as the season advanced more plants adopted this means of unloading. When the season ended, only four plants were without fish pumps, or access to them. One of these, having a more favorable location and a vertical hoist, started hoisting fish from purse seine boats, near the end of the season.

Figure 8 based on table II giving the tonnage of the purse seine boat as compared with the lampara boat, shows a steady increase in tonnage delivered by the purse seine boat until the last month of the season, when a decrease is shown. This steady increase until the month of February can be accounted for by the increase in numbers of purse seine boats as the season progressed, and by the fact that there were practically no limits between October 15 and February 5 for any of the canneries. The drop in tonnage of the purse seine boat from February 1 to February 15 was due to fish appearing in the bay in quantities where they were available to the lampara boats and the setting of limits again by most canneries, as well as the early departure from Monterey of some of the purse seine boats.

Scofield in his report, "Sardine fishing methods at Monterey, California" (pp. 56-59) discusses at length the subject of limits. Data collected at the time samples of fish were taken during the 1929-1930 season, indicated that there were no limits imposed during 75 per cent of the time. Although the limits for the lampara boats at any one cannery would be the same, the purse seine limits might vary at the same cannery. The usual procedure was for a purse seine boat captain to make arrangements with a cannery before starting to fish. In actual tonnage, the limits favored the purse seines, but on a capacity basis the limits were comparatively equal. The limits imposed on the lampara boats varied from 15 tons (at the start of the season) to 45 tons, the limit occurring most frequently being 30 tons.

Table III (fig. 9), giving the monthly total number of deliveries made by the two types of boats, shows that the purse seine boat deliveries throughout the season were fairly uniform, fluctuating between 139 and 236 deliveries for any month. The lampara boat deliveries fluctuated between 224 and 1000 deliveries for any month.

Table IV (fig. 10) shows a steady increase in tons per delivery of the purse seine boat, until the last half-month of the season. This increase in tons per delivery is accounted for by practically no limits being placed on the boats between October 15 and February 5. The decrease in February of the purse seine boat tonnage, is due to limits being set.

4. COMPARISON OF REPRESENTATIVE BOATS

All of the above data presented up to this point are given in terms of the total number of boats of the two types at Monterey. A more accurate method of judging the success of the two types would be to compare several boats that fished throughout the season. This has been

¹²The suction pump at Monterey consists of a large floating hopper receptacle, into which the fish are unloaded. A pipe varying from 6 to 10 inches in diameter leads from the hopper to the cannery. The fish are sucked through by means of an electric motor at the cannery end of the pipe.

done in the following manner: Six boats of each type were taken and the results averaged to represent one boat of each type. These six boats were chosen by first looking through the purse seine list and setting aside those boats that had fished throughout the season. The data begin with the month of September as some of the purse seine boats were tardy in starting the season, nearly half of those fishing in August not arriving until after the middle of the month. It was found that only 9 boats of the 16 delivering during August finished the season,

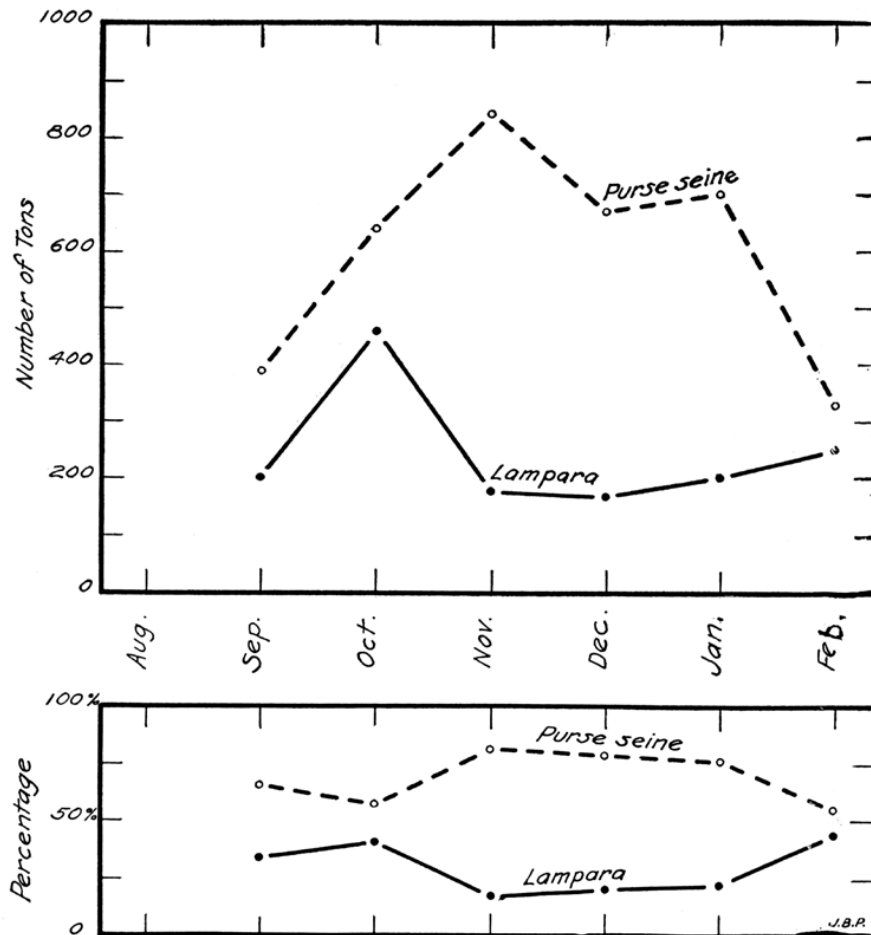


FIG. 12. Average monthly tonnage of six boats of each type.

FIG. 12. Average monthly tonnage of six boats of each type

the other boats meeting with accidents or else going to San Pedro. of these 9, two used ring nets and these two were excluded to obtain a purely purse seine representation. of the 7 boats left, the 6 that had started the season the earliest were kept to represent the purse seine boats. On the other hand, the list of lampara boats that were represented in deliveries each month was so long that the boats were arranged alphabetically and every seventh boat chosen. The 6 boats of each type that were selected are as follows:

Purse seine
 Ambassador
 Anadir
 Agnes S.
 Conquest
 Marie-Joan
 New Admiral

Lampara
 C. & B. Aiello
 S. Compagno
 J. Davi
 E. S. Lucido
 S. Oyama
 S. Ventimiglia No. 2

In the ensuing tables, the totals for the 6 boats were taken and averaged to represent a typical boat, and the month of August omitted, as previously explained. Table VI shows the actual average (typical boat) tonnage of the two types of boats, together with the percentage represented by the tonnage. Figure 12 is based on this table.

TABLE VI
Average of Six Boats of Each Type

Month	Actual tonnage			Per cent of total		
	Lampara boats	Purse seine boats	Total	Lampara boats	Purse seine boats	Total
August						
September	205	393	598	34	66	100
October	463	641	1,104	42	58	100
November	183	846	1,029	18	82	100
December	177	671	848	21	79	100
January	206	702	908	23	77	100
February	256	330	586	44	56	100
Season	1,491	3,582	5,073	30	70	100

TABLE VI
Average of Six Boats of Each Type

Table VII gives the number of deliveries made by a typical boat of each type (pictured in fig. 13); table VIII, the tons per delivery (fig. 14).

TABLE VII

TABLE VIII

Month	Lampara	Purse seine	Month	Lampara	Purse seine
August			August		
September	12	10	September	17	39
October	18	15	October	26	43
November	9	15	November	20	56
December	5	9	December	35	75
January	6	8	January	34	83
February	7	6	February	37	55
Season	57	63	Season	26	57

TABLE VII and VIII

While the trend of the tonnage of the lampara boat in figure 12 is in general the same as the trend in figure 8 for all the boats, that of the purse seine tonnage (fig. 12) shows an increase until the end of November, and then a decrease in general until the end of the season, February 15. The purse seine tonnage at all times, however, remains above that for the lampara. The increase in tonnage delivered by purse seine boats as shown in figure 8, in contrast to a decrease for the same months shown in figure 12, is explained by the increase in number of larger capacity purse seine boats as the season progressed. (Figure 8 is based

on the total tonnage of all boats while figure 12 pictures the average of 6 representative boats of each type.) The decrease in figure 12 is due to the purse seine boats making long trips to the northern fishing grounds, the time to and fro cutting down on the available fishing time. This is verified by figure 13, showing a decrease in number of deliveries from November on, while at the same time the tons per delivery increased (see fig. 14).

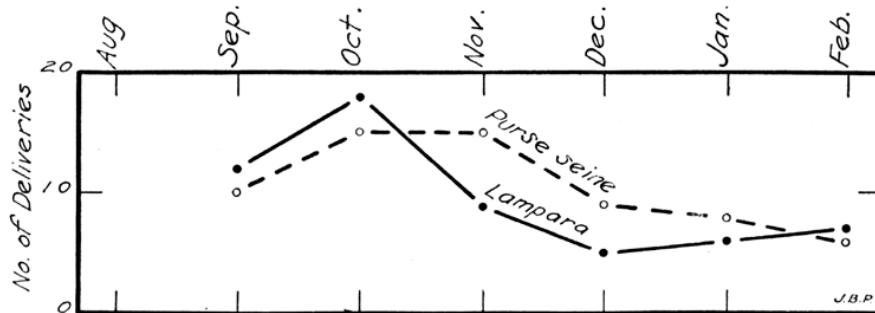


FIG. 13. Average number of deliveries of six boats of each type.

FIG. 13. Average number of deliveries of six boats of each type

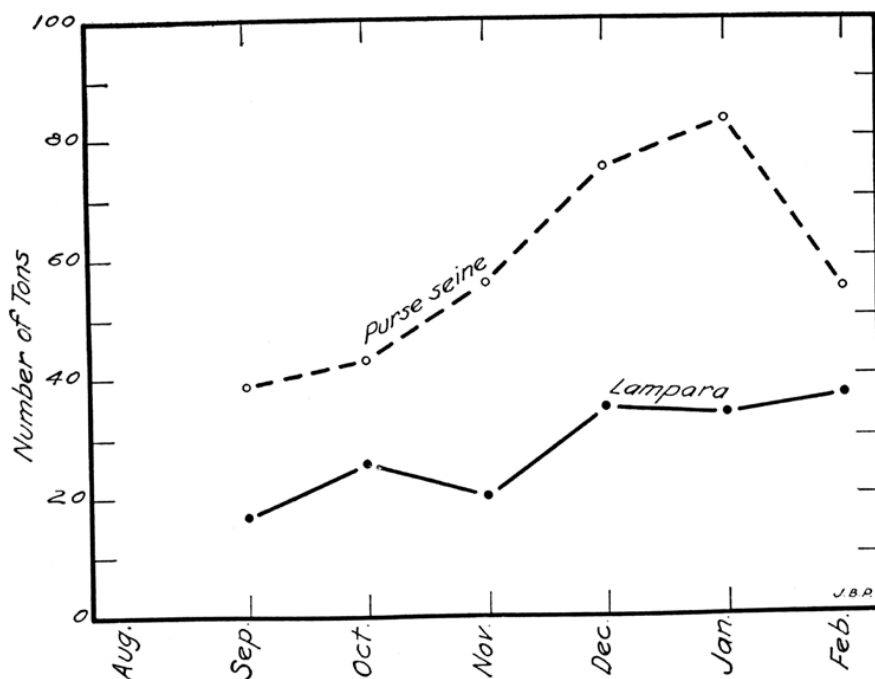


FIG. 14. Average number of tons per delivery of six boats of each type.

FIG. 14. Average number of tons per delivery of six boats of each type

5. CATCH LOCALITIES

Inasmuch as the success of the purse seine boats at Monterey hinges on the fact that they are able to go long distances for their catches when necessary, the following catch locality maps are presented. The months are grouped into the Fall Fishery (fig. 15, August-September-October), Winter Fishery (fig. 16, November-December-January), and Spring

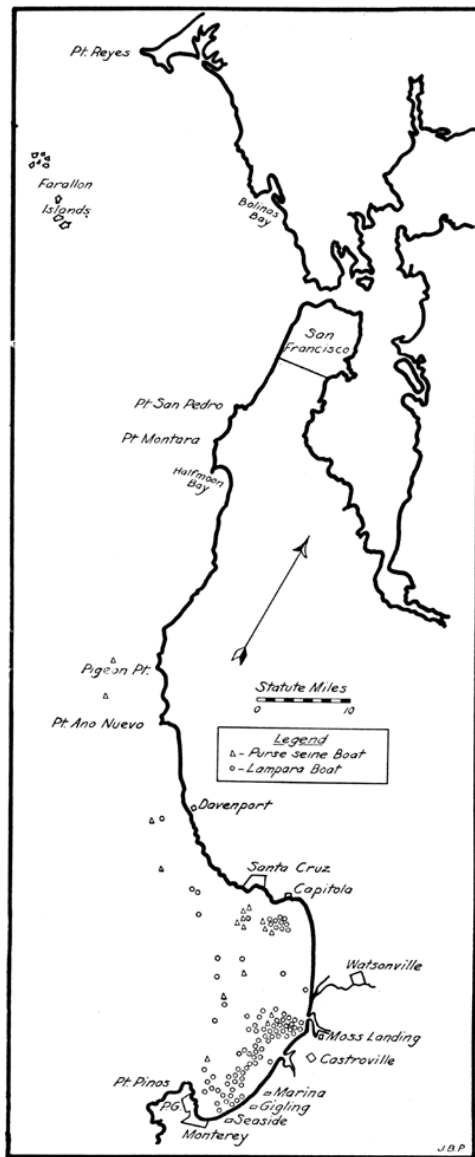


FIG. 15. Locality of catches during the Fall Fishery (August-September-October).

FIG. 15. Locality of catches during the Fall Fishery (August-September-October)

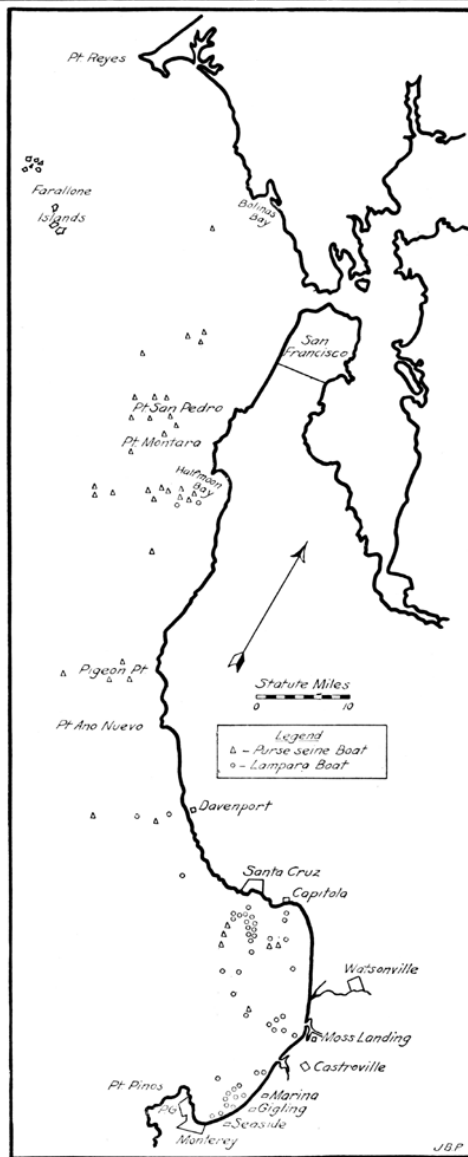


FIG. 16. Locality of catches during the Winter Fishery (November-December-January).

FIG. 16. Locality of catches during the Winter Fishery (November-December-January)

Fishery (fig. 17, February 1–February 15). Figure 18 is a season map, a combination of the three. In these maps the catches of purse seine boats are represented by triangles, and of the lampara boats by circles. The catch locality data are based solely upon the information obtained from fishermen on the days that sardines were sampled. Five samples were taken each half-week, each sample preferably at a different cannery; the following sample day, repetition of canneries was avoided as much as possible. This method of sampling is representative of the fleet, and is based upon Sette's trials in 1919–1920 of the adequacy of various methods of sampling at Monterey.¹³ Therefore, each triangle and circle represents information obtained with one of the five samples that were taken on the sampling day.

A rough idea of the tonnage taken from various localities as a whole may be had by dividing the actual total tonnage of each type of boat by the number of times it was represented in the sampling for the season, *viz.*:

$$\begin{aligned} \text{Lampara boat : } & \frac{96,354 \text{ (Season tonnage)}}{147 \text{ (No. times sampled)}} = 655 \text{ tons, each circle} \\ \text{Purse seine boat : } & \frac{62,912 \text{ (Season tonnage)}}{58 \text{ (No. times sampled)}} = 1,085 \text{ tons, each triangle} \end{aligned}$$

SAMPLING

Figure 15, which represents the Fall Fishery of the months August-September-October, shows the bulk of the catches confined to Monterey Bay and a uniform scattering to Davenport (Cement Plant). An occasional catch is registered off Pigeon Point. Figure 16, representing the Winter Fishery of the months November-December-January, shows an extension of the fishing grounds northward as far as Bolinas Bay. The period of scarcity of fish falls within these months. A rough estimate, on the basis of the formula given previously, portrays the region north of Pigeon Point as having produced, roughly, 50 per cent of the tonnage for this three-month (winter) period. During this period, a few lampara boat catches are represented off Halfmoon Bay. The small boats will venture this far occasionally, but the handicap of towing a lighter and their consequent slow speed, prohibits them from making trips very far to the northward when water and weather conditions are not satisfactory. The catches in Monterey Bay, from the middle of November until the first week of January, were mixed as to size of sardines. During the first part of January, there were several loads of sardines of 7- to 8-inch length brought in that were caught within the bay. The smaller sardines were not wanted by the canners, as the small fish required a double row pack, for which there was no demand. Consequently, although there were smaller size sardines within Monterey Bay during January, the crews were asked to refrain from bringing in these catches. On the other hand, the boats were bringing in large uniform fish from the northern fishing grounds during this period. Figure 17, representing the Spring Fishery starting with February and ending with the close of the season on the 15th, shows a shifting of the catches back to the Monterey Bay vicinity. This shift

¹³ Sette, O. E. Sampling the California sardine: A study of the adequacy of various systems at Monterey. *In* The California Sardine. California Fish and Game Commission, Fish Bulletin No. 11, p. 67–122, 1926.

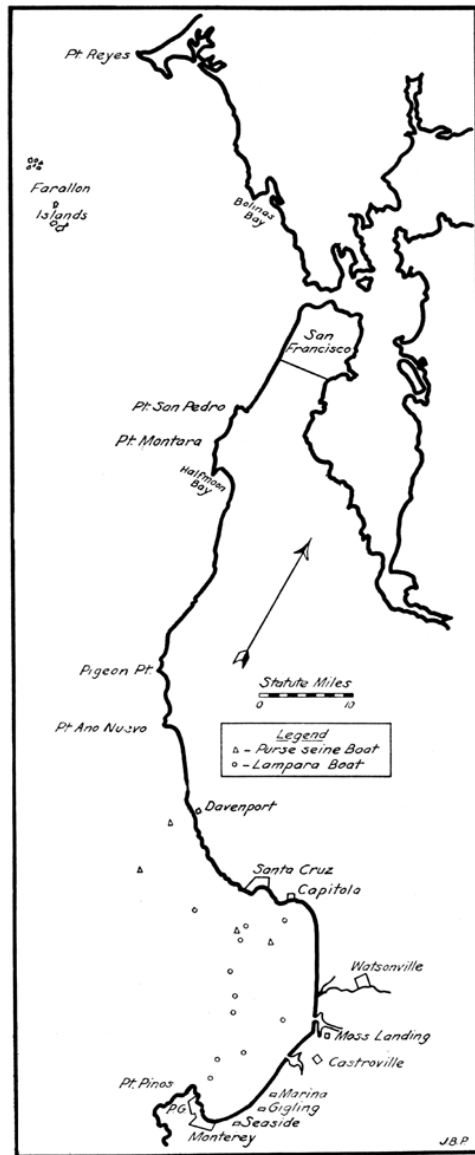


FIG. 17. Locality of catches during the Spring Fishery (February 1-15).

FIG. 17. Locality of catches during the Spring Fishery (February 1-15)

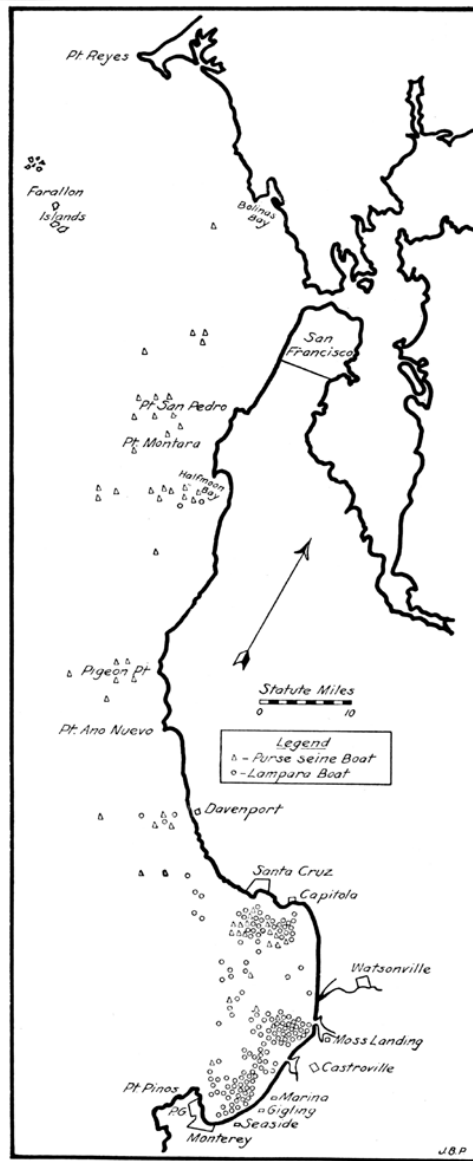


FIG. 18. Locality of catches during the 1929-1930 season.

FIG. 18. Locality of catches during the 1929-1930 season

occurred about two weeks later than in the preceding season of 1928–1929.

The seasonal map (fig. 18) is a combination of the other maps. It can be noted that roughly 30,000 tons, or approximately 20 per cent of the catch for the entire fishing season, was from the region north of Pigeon Point. Until the fall of 1929, this region was tapped but slightly. Table IX shows that 1929–1930 exceeded 1928–1929 by approximately 40,000 tons or 34 per cent. If 30,000 tons were delivered from north of Pigeon Point, the region to the south yielded in the latter season an increase of only 10,000 tons or 8 per cent.

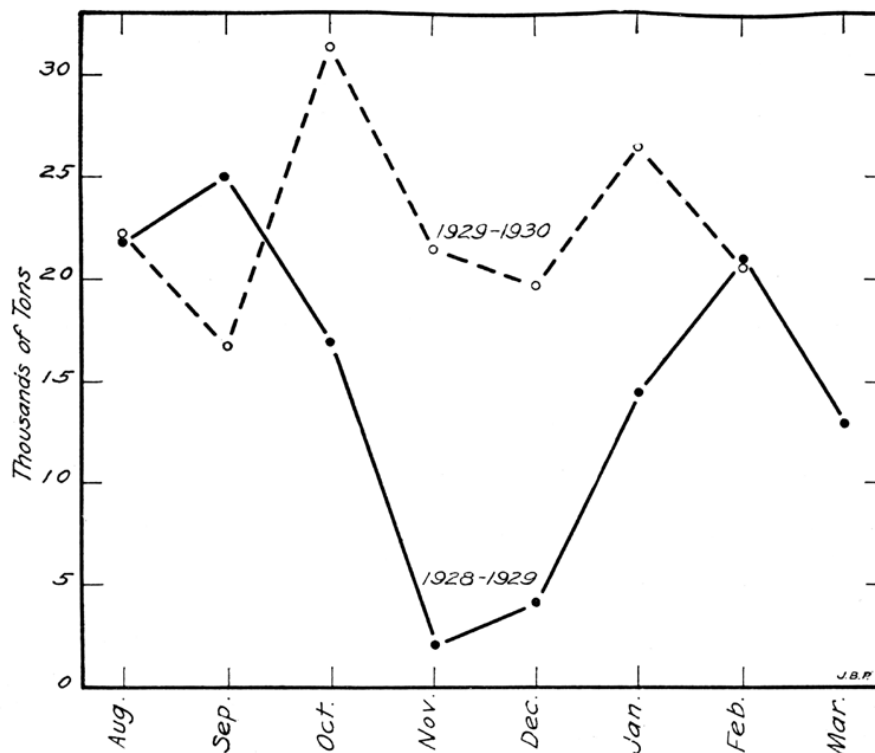


FIG. 19. Total monthly sardine tonnage delivered at Monterey canneries for two seasons.

FIG. 19. Total monthly sardine tonnage delivered at Monterey canneries for two seasons

From the above it appears, off-hand, that the Monterey Bay region north to Pigeon Point is reaching a maximum production, and in the future all things remaining equal, the region from Pigeon Point north will be depended on chiefly for the additional demand resulting from the increased number of plants and increased plant capacities. How much strain this region can stand is problematical at the present time, but should be kept in mind by those directly concerned. The region from Pigeon Point to Point Reyes appears to be the only reserve fishing grounds now left for the Monterey canneries. The demands of the previous seasons have seen a pushing northward of the fishing grounds. The demands of this season have apparently seen a limit to the northward extension, with present equipment.

6. COMPARISON OF 1928-1929 AND 1929-1930 SEASON

The total monthly and seasonal tonnage for the 1928-1929 and the 1929-1930 seasons is compared in the following table IX, and pictured in figure 19. This comparison is made irrespective of gear.

TABLE IX
(Figures to the nearest ton)

Month	1928-29	1929-30
August.....	21,966	22,316
September.....	24,935	16,865
October.....	17,070	31,417
November.....	2,163	21,474
December.....	4,260	19,733
January.....	14,597	26,610
February.....	21,071	*20,851
March.....	*13,095	-----
Season.....	119,156	159,267

* Represents half-month only.

TABLE IX
(Figures to the nearest ton)

The total tonnage for the 1929-1930 season was 40,111 tons (33 to 34 per cent) greater than that for the 1928-1929 season. Practically all of this added tonnage came during the months of October to January, the greatest increase being in November and December. Comparing table IX with table II, it is interesting to note that during these two months the lampara boats alone had a much greater tonnage for the 1929-1930 season than they did during the 1928-1929 season. This was due very probably to the greater efficiency of the ring net, which was adopted in preference to the lampara.

A part of the added tonnage for the 1929-1930 season can be attributed to 3 new plants operating, and also that the "overage" allowance (whole fish allowed to go direct to reduction plant) was 32½ per cent of the monthly tonnage as against 25 per cent for the 1928-1929 season. Even with these factors considered, there is an excess of tonnage over the 1928-1929 season. This in the face of the fact that the 1929-1930 season was approximately a month shorter, because of new legislation closing certain months to the canning of sardines in the pound oval tins.

7. SUMMARY

The adoption of the ring net by the lampara crews in a wholesale manner during the 1929-1930 season was in itself an endorsement of the purse seine type of net. The question then remaining was that of size and type of boat, with which this paper deals in the main. After reviewing the data presented, the following summary seems apparent: That the purse seine boats are more dependable for a steady cannery supply of sardines than the lampara, inasmuch as they are able to go great distances for their catches when necessary. Their greater capacities enable them to bring in larger amounts from the more distant regions to carry the canneries over the periods of scarcity of fish on the nearby fishing grounds. On the other hand, it might be said that the loads from the more distant regions would be in poorer condition for canning. However, with as much overage leeway as there is at the present time, this question is not so significant. If in the future the percentage of

overage should be reduced materially and fish in very good condition demanded at all times, the purse seine boat, because of its size and because its catch is carried aboard and not in a lighter, will be in a position to make provisions for chilling the fish or partitioning the hold if necessary, to keep the catches from the distant regions in good shape.

But it should not be taken for granted that the lampara boat can not compete with the purse seine boat. Now that the lampara crews have adopted the ring net, they are in a better position than the purse seine boat to make quick catches when the fish are close in or in scattered schools, as the outstanding feature of the ring net is the speed with which it can be handled. The lampara boats undoubtedly will increase in efficiency in the future now that skill in handling the new net has been acquired.

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This opportunity is taken to acknowledge the assistance of members of the staff of the California State Fisheries Laboratory, especially that of Mr. W. L. Scofield, the acting director, who suggested the problem and offered much helpful criticism in the preparation of this report.

Scofield, W. L. Purse seines for California sardines. *California Fish and Game*, Vol. 12, No. 1, pp. 16–17, 1926:

"There were several reasons why the purse seine of the early days failed to yield a steady supply of fish. In the first place the fishermen were not familiar with the habits and the movements of the sardine. The schools were located by seeing fish jump at the surface or by seeing the fish in shallow water in the daytime, and fishing at first was confined to the daylight hours. Later it was discovered that sardines could best be located at night by the phosphorescent light resulting from their movements in the water, and as a result daylight fishing was gradually abandoned. The early purse seines were circled by hand from skiffs and pulled by hand, with the result that the "lay-out" and the pursing were delayed allowing the sardines to dive under the lead line, also running up costs of operation. Another reason for early failure at Monterey was the fact that gear (net and boats) was furnished by the cannery, and the fishermen were paid wages by the month, so there was small inducement to scout for fish or to acquire the knowledge necessary for success in a new fishery.

"The lampara net, which was imported from Tangieria, was successful from the first and revolutionized sardine fishing in California. It yielded a greater and more continuous catch and was cheaper to operate than the purse seine. A crew of nine men with the lampara could do the work of twelve with a purse seine. However, the discovery of night fishing and increased skill and knowledge were contributing factors to the success of the lampara."

Scofield, N. B. The purse seine. *California Fish and Game*, Vol. 10, No. 4, pp. 182–186, 1924.

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Skogsberg, Tage. Preliminary investigation of the purse seine industry of southern California. *California Division of Fish and Game, Fish Bulletin No. 9*, 1925.

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