CAL. FISH + GAME, 1962 48(4) 256-26

FRY 1962

POTENTIAL PROFITS IN THE CALIFORNIA SALMON FISHERY[1]

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INTRODUCTION

More and more water and power projects are being built in California. Many of these will put dams in the paths of migrating fish, flood out their spawning areas and divert their spawning streams. In such instances, the Department of Fish and Game is legally required to order the construction agency to take appropriate steps to minimize damage to fish life by installing fishways, fish screens or fish hatcheries. Other state and federal statutes require the Department to report on and recommend other protective or compensating measures, including water releases to maintain fish life, and suggest changes in the project's design and operation to maintain and enhance these resources.

The Department is not required to demonstrate the cash value of these fish in order to take steps to save them. Neither is the U.S. Coast Guard required to demonstrate that a sailor on a sinking ship is worth what it will cost to rescue him. In either instance, the victim's death would be apt to occur before the matter could be settled. This does not mean the Department can ignore the species or numbers of fish involved. Often, extensive studies must be carried out in order to determine how best to provide for fish runs, but such studies are based primarily on biology and engineering rather than on economics.

Sometimes when studying a project it becomes evident that not only can runs be maintained but by spending a bit more money they can be increased. At this point, economics become of primary importance. Government agencies are required to regard fish production as one of the beneficial uses of water. If, in a state or federal project, an additional expenditure would increase the run above its former (pre-project) level and the extra fish produced would more than offset the cost of producing them, there is an excellent chance that money to increase the run will be forthcoming. Conversely, if the cost of providing *extra* fish exceeds their value, the project will usually supply finances to maintain the run at its natural level—but no more.

Once the cost of producing extra fish is known, the problem can be settled by determining the value of each fish. Unfortunately there are all too many ways to calculate this, and the answers are ridiculously far apart. For commercially-caught salmon, values from zero to well

[1] An evaluation of the fishery based on a method suggested by Dr. James Crutchfield, Associate Professor of Economics, University of Washington, Seattle. Submitted for publication May 1962.

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above the retail cost-per-pound have been seriously suggested. In this paper, I will present a method of evaluating commercial salmon; sport-caught fish pose altogether different problems and will not be discussed.

Quite logically, men who evaluate water projects want to be able to appraise the fisheries involved by methods comparable to those used on other parts of the project. Most values assigned to water, for example, are based on the increased profits that will be realized. A plot of land will ordinarily produce more if irrigated than if dry-farmed, but the costs of farming will be greater. Profits due to irrigating are calculated by deducting the extra expenses from the extra money gained from the larger (or different) crop. Commercial fisheries' values, on the other hand, have usually been expressed by the Department of Fish and Game as the total received for the fish at dockside, or sometimes at the wholesale level, with no deductions for the cost of catching them. On occasion this has led to the fisheries receiving little consideration because no one had calculated the profits involved. Some economists have insisted that, according to economic standards sometimes used in business, many fisheries (including salmon) have no value because the fishermen could have made as much or more at almost any other job—the fishermen were, in effect, running a small business, paying themselves a bare minimum wage for long hours of hard work and, on the average, making no money whatever on their investment.

Some American traditions and laws tend to reduce a fisherman's cash profit (above day wages) to the vanishing point. Truly efficient fishing gear is outlawed in the interests of conservation or to spread employment among as many people as possible. In California, for example, commercial fishermen may take salmon only by trolling—a grossly inefficient method made a trifle less so by a large investment in mechanized gear and electronic fishing aids. There is no limitation on the number of men who may enter this business. If too many do enter it, catches of individual fishermen fall off and the least efficient or most easily discouraged individuals drop out. If the dictates of conservation demand it, the State may hasten the process by shortening the season. Limiting the number of boats and thus letting each make a fair living would be one approach—but our society has not chosen to use it. We *do* use this approach in some businesses such as radio and television stations, liquor stores, and power plants. It is often against the profits of a power-plant monopoly that fisheries' profits are compared.

A farmer is allowed to own or lease land and manage it as efficiently as he is able. His crop is not open to harvest by anyone who comes along. A fisherman has no such protection even though his investment in boat and gear may exceed the cost of a farm. He must share the harvest with everyone who enters the fishery and is often compelled by law to operate very inefficiently.

Obviously, if the net economic yield concept is to be used to compare such differently managed businesses as power generation, farming and commercial fishing, it must be modified. For commercial fishing this could be done by calculating the profits a fishery would realize if it operated as a virtual monopoly, if it used the most efficient gear and if the catch were adjusted to that which the resource could continuously produce under best management practices. For the salmon fishery of California's Central Valley, such profits can be calculated without wandering too far into fields of conjecture.

A HYPOTHETICAL SALMON FISHERY

I will describe a fishery which has been proven efficient. *I am not proposing that such a fishery be created;* it is only used as a method to calculate the potential net benefits of the resource—nothing else is implied.

Assume that all commercial trolling was stopped and all commercial catches were made where they could be taken most efficiently. The Sacramento-San Joaquin Delta would be an excellent area—the fish are still in prime condition (they are mature and have reached their maximum growth). A fishery would get maximum production out of Sacramento-San Joaquin fish. It would not harvest fish from other California rivers, but there is no reason why similar but smaller fisheries could not be established in other streams.

Salmon in inland waters could be caught by many methods. Some of these are proven ones, having been used either in California or other parts of the world. Even electrical fishing could be considered in a study to determine the cheapest way to harvest fish; however, I have chosen proven methods for this model in order to be on firmer ground when calculating costs. Some which might be used are:

Salmon traps similar to those recently used in Alaska were once used in California but were not particularly effective in this State and were gradually being abandoned when the Legislature outlawed them.

A dam with a fishway. This would have to be constructed upstream from the levee system controlling the lower river. Fish taken this far upstream would be approaching spawning condition and their desirability would be greatly reduced. Furthermore, capital investment would be very high, particularly because several streams would have to be dammed.

Fishwheels have not been proven on the Sacramento. In any event, suitable sites are so far upstream that fish quality would have deteriorated badly.

Beach seines once met with moderate success but would never harvest the entire crop. There are not enough suitable seining sites in the Delta or in the lower Sacramento River.

Gill nets were the only gear which proved successful for many decades in the inland waters of the Central Valley. Legislation reduced their effectiveness through the years, and gill-net fishermen had to be content with salmon that had escaped the expanding troll fishery. Finally, in 1957 salmon gill-netting was outlawed completely. A small gill-net fleet could be very effective if it operated to take the maximum sustainable yield for the lowest reasonable cost.

In the last decades of the fishery, many gill-netters operated from Carquinez Strait to Pittsburg—an area with much open water which gave the fish a chance to scatter. Carquinez Strait is narrow but it is deep, has violent tides and such heavy boat traffic that the ship channel must be kept free of nets. In the strait and other downstream areas, *the boats had first chance at migrating fish but they were fishing in* the large end of the funnel. Farther upstream in the Sacramento River, from Collinsville to Rio Vista and corresponding places on the San Joaquin, the boats were at the small end of the funnel but were catching only those fish that had escaped trollers *and* downstream gill-netters. To make sure they did not catch too many salmon, gill-netters were required to stop fishing on weekends.[2] The season closed September 26—at the peak of the fall migration—and did not open till November 15, by which time the run was down to a dribble. There was another closed season in early summer, but not nearly as many fish were moving at that time. All these restrictive measures (closed seasons, closed areas, etc.) were imposed largely because there were too many boats.

Assume that instead of a large fleet scattered over a wide area, a *small fleet fished in the small end of the funnel. Assume that instead* of having two lengthy closed seasons, the fleet was kept small enough to permit the necessary escapement. This could be done by restricting the number of boats fishing when salmon were relatively scarce. The weekend closure could be lengthened when more escapement was needed and eliminated in times of excessive abundance. Assume also that this fleet was manned exclusively by competent fishermen. Such a fleet could harvest the Sacramento-San Joaquin at a very low cost.

WHAT WOULD BE THE SIZE OF THE HARVEST?

Obviously if there were no troll fishery, many more salmon would enter the Delta. Tagging and marking experiments have demonstrated that landings of salmon *produced* in the Sacramento-San Joaquin River *system exceed the total salmon from all sources which are landed in* California. In other words, tonnages of Central Valley salmon taken by trollers off Oregon, Washington, and Canada exceed all California catches of salmon from rivers outside the valley. Extensive additional analysis and possibly some additional marking experiments will be needed to demonstrate the amount of this excess, so for this study total state salmon landings will be used as a measure of how many pounds could be taken in the Delta if there were no troll fishery. This is a minimum figure, not only for the reason given above but because trollers keep many 5-pound salmon that two years later would weigh 20. In some years, the average weights of gill-netted salmon were almost twice those of troll-caught fish. Furthermore, many still-smaller fish are unintentionally killed in the course of being hooked, unhooked, and returned to the water.

Average salmon landings over the 10 years 1952-1961 were 7,895,000 pounds, which will be used as the average catch of our hypothetical gill-net fleet operating in the Delta.

How would the catch be distributed through the year? To determine this, the monthly gill-net catch of each of the last 10 complete years of the fishery (1947 through 1956) was expressed as a percent of that year's total catch and then averaged (column 1, Table 1). During this period, there were closed seasons during all of July and October, half

[2] Weekly closed periods are useful to permit escapement and should probably be retained even with a much smaller fleet.

TABLE 1

Theoretical Catch of a Gill Net Fishery Operating All Year

	Col. 1	Col. 2	Col. 3	Col. 4
	Average percent of yearly catch 1946-1955	Column 1 expanded for closed periods	Calculated average percent of yearly catch	Catch per month calculated from Col. 3
January	.69	.69	.39	31,000
February	2.15	2.15	1.21	96,000
March	1.88	1.88	1.06	84,000
April	3.15	3.15	1.78	141,000
May	5.62	5.62	3.17	250,000
June	1.05	2.10[1]	1.18	93,000
July	--	6.05[2]	3.41	269,000
August	7.10	10.00[3]	5.64	445,000
September	76.53	88.30[4]	49.85	3,935,000
October	--	54.63[5]	30.84	2,435,000
November	.77	1.54[6]	.87	69,000
December	1.06	1.06	.60	47,000
	100.00	177.17	100.00	7,895,000

[1] June—Col. 1 doubled (15 days closed).
[2] July—Interpolated between June and August (after expanding Avg.).
[3] Aug.—x 31/22 (9 days closed).
[4] Sept.—x 30/26 (4 days closed).
[5] Oct.—Used ratio of Sept. to Oct. catches taken by Fish and Game employees in tagging traps operated in the lower Sacramento River 1953-1956.
[6] Nov.—Doubled (15 days closed).

of June and November, the first nine days of August and the last four days of September. To make a somewhat better estimate of the probable catch of a gill-net fleet operating throughout the year, the June and November catches were doubled, the August catch was multiplied by 31/22 and the September catch by 30/26. The July catch is an interpolation between those of June and August since trap catches made by Fish and Game personnel in the lower Sacramento River indicated the run was gradually picking up over this period. The October catch was estimated by averaging our September and October trap catches for four years and using the ratio of the average September to the average October catch (column 2).[3] Since this yielded 177.17 percent, it was reduced to 100 percent by multiplying each month's catch by 100/177.17 (column 3). Finally, the last column contains the theoretical monthly poundages that would be landed, assuming a total catch of 7,895,000 pounds. These figures will be used even though the total catch probably could be greater because only full-grown fish would be harvested.

HOW MANY BOATS WOULD BE REQUIRED?

The Sacramento-San Joaquin gill-net fleet increased from about 100 boats in 1872 to about 750 in 1909 and then gradually declined to about 150 in the mid-30's. In 1946, each of 242 boats landed 1,000 pounds or

[3] *See* Hallock, Fry, and LaFaunce (1957). The traps were fished through September and October in each of four years, but were operated from June through August in only one year.

more for the season.[4] The 1909 fleet, presumably oar or sail powered, covered a much larger area than was legally fishable in later decades, but still overcrowded the fishing grounds. The 242 boats fishing in 1946 were covering a wider area than would be necessary for a smaller fleet —and they too were overcrowded. This fleet was gasoline powered but, with possibly one or two exceptions, nets were pulled by hand. Our hypothetical fleet would have power-driven net rollers and one man could handle a boat except during the height of the fall season. How many such boats, placed in the most strategic areas, would be required to take about 8,000,000 pounds per year?

In 1946, the gill-net catch was 6,463,000 pounds—the highest year in which we have records of catches of individual boats. The September catch in 1946 was 3,674,000 pounds, although the season ended September 26. Had fishing continued through September 30, the catch would almost certainly have exceeded 4,250,000 pounds—more than we would expect from our hypothetical fleet in an average September.

The 1946 fleet had 219 boats fishing in September. There were too many of them; they got in each other's way. Boats and nets drift with the tide, and on the better drifts boats lined up and had to await a turn. Each boat caught some fish, alarmed others, and made fishing worse for the boat behind it. Half as many boats fishing the same drifts would have had a much better average-catch-per-boat. A quarter as many boats fishing only the best drifts would have had still better catches.

The 59 poorest boats took only 283,000 pounds (Table 2). The remaining 160 boats took over 3,390,000 pounds and had they fished at the same rate through September 30 would have taken over 3,900,000 pounds.

Without a troll fishery, salmon in an average year would be more abundant than in 1946—catch-per-boat would be greater and a smaller fleet would suffice. We do not want our small fleet to take as high a proportion of the fish as the old fleet did—we want enough fish to get past the nets to eliminate all need for lengthy closed seasons.

TABLE 2
Sacramento-San Joaquin River Fishery, September 1946
Salmon Boat Catches

Catches in thousands of pounds	*Number of boats*
Under 5,000	30
5,000- 9,999	29
10,000-14,999	30
15,000-19,999	46
20,000-24,999	39
25,000-29,999	29
30,000-34,999	12
35,000-39,999	2
40,000-44,999	1
45,000-49,999	1
	219

[4] From Fry (1949), and unpublished records of the Department of Fish and Game.

The 1946 fleet pulled its nets by hand. Power rollers will bring a net in faster and with less effort and more time can be spent actually catching fish.

The 1946 fleet used linen nets—linen is relatively inefficient, especially in the daytime. When nylon nets were tried in the Delta they took many more fish than linen.[5] Monofilament nets were developed after all net fishing had been outlawed in the Delta. They have been used in other areas and took from two to more than three times as many fish as nylon nets with which they were competing.[6] Monofilament nets have been outlawed in Washington and British Columbia—they are too effective.

The 3,900,000 pounds that the 160 ''high'' boats in 1946 would have taken had they been allowed to fish through September 30 were about what our hypothetical fleet would be expected to take in September. Without their 59 inefficient competitors, a somewhat smaller fleet could have done the job. Probably fewer than 40 boats would be required to take 3,900,000 pounds if they were using power pullers and fishing in the best places with nets capable of catching several times as many fish, and with salmon at a higher level of abundance. To allow for higher catches in above-average years, I am proposing a hypothetical fleet of 50 boats. These 50 boats would probably be able to take so much fish that weekend closures would be needed in most years to permit adequate escapement. The lengths of these closures could be varied to suit the sizes of the runs.

Thus far I have stressed the fishery as it could be expected to exist in September, since that is the peak month and the one in which, historically, the largest catches were always made. In recent decades, October was always closed. Our hypothetical fishery could expect to make excellent catches in October. Based upon experimental fishing by department employees near the mouth of the Feather River, October catches would average about 62 percent as much as those made in September.

The limiting factor during September and October would not only be the catching capacity of the nets—it would include the fishermen's endurance. During the rest of the year neither of these problems would be serious and fewer boats could do the job. Ten boats would probably be sufficient to harvest the catch during 6 of the 12 months (Table 3). It might be necessary legally to limit the number of boats by law which could fish during months other than September and October, but economics probably would do a fairly good job of regulation. In the past only a small part of the fleet was fishing during poorer months.

[5] The most comprehensive comparison of nylon and linen gill-net catches I found was that by Davis and Posey (1959). They compare catches made with several mesh sizes and three twine sizes of cotton, two of linen, and five of nylon that could be directly compared with the cotton and linen. Gill nets and trammel nets were among the gear tested. (A trammel net is a highly modified form of gill net—both gill and trammel nets were used in the Delta salmon fishery.) The number of net days of fishing ran into the thousands. Comparing the most effective twine size of nylon with the most effective linen twine size for each mesh size, the weight of fish taken by nylon trammel nets averaged about 2.5 times that taken by linen trammel nets, and nylon gill-net catches averaged about 3.5 times those of linen gill nets. (Cotton ran third.) Monofilament was not included in their tests.

[6] *Pacific Fisherman* (1961) states that in the Japanese high seas salmon fishery of 1961, the catch rate of monofilament nets is reported to have averaged 2.5 times as much as for the conventional multifilament nylon nets.

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TABLE 3

Fleet Needed to Harvest Sacramento-San Joaquin Salmon

	Thousands of pounds to be landed[1]	Boats fishing	Fishermen fishing
January	31,000	10	10
February	96,000	10	10
March	84,000	10	10
April	141,000	15	15
May	250,000	20	20
June	93,000	10	10
July	269,000	15	15
August	445,000	20	20
September	3,935,000	50	100
October	2,435,000	50	100
November	69,000	10	10
December	47,000	10	10
	7,895,000	230	330

[1] These are the theoretical catches that would be made if the timing and relative size of the runs averaged the same as they did from 1947-56. Department of Fish and Game men believe that, at present, the winter run would be larger and the spring run smaller than shown above.

COST OF FLEET OPERATION

Because we might want as many as 50 boats fishing at the peak of the best years, costs will be calculated on the assumption there are 50 boats in the fleet and that all are allowed to fish during September and October of every year. During a poor year, it would be necessary to close the season enough days per week to let enough salmon escape to maintain the run. We will assume that in an average year, 25 fishing days per month would be permissible including any lost because of bad weather. (Bad weather rarely is a problem in the Delta.) During September and October, each boat would be operated by two men. During the rest of the year, only one man per boat would be required. Fewer boats would be licensed to fish from November through August in the event smaller catches did not automatically reduce the active fleet.

In any fishery which is at its peak for only two months each year, most of the fishermen would have other jobs during much of the year. Historically, many gill-net fishermen migrated to Alaska to work in other gill-net fisheries. Some entered other seasonal fisheries and still others had nonfishing jobs.

An adequate gill-net boat with engine can be built for as little as $6,000. Because our fleet would have to be in top condition, I am allowing $7,500 per boat—$6,000 for the hull and $1,500 for the motor. The hull would have a useful life of about 20 years and could be sold for about $1,000 at the end of that time, making a net cost-per-year of $250. The motor would have a useful life of only 10 years, and would be worth about $300 on a trade-in, making its net cost-per-year about $120.

Proper maintenance of boat and motor would require a cash outlay of about $300 per year. This is based on the assumption that much of the maintenance (especially hull maintenance) would be done by the fishermen themselves. (It nearly always is.) Using $20 per working day as a fisherman's wages and allowing 20 days per year of maintenance work, would add $400 per year to maintenance.

A nylon net which normally would have a life of about two years can be purchased for about $1,500. To allow for accidents and for heavier usage than normal, I based costs on a useful life of 1½ years at $1,000 per year. Allowing 20 days per year of a fisherman's time for net work adds $400.

All these costs total $2,470 per year per boat exclusive of fuel and oil. Gasoline and oil would probably cost about $6 per day or $150 per 25-day boat month. Fuel and oil costs will, of course, be applicable only when boats are operating.

Fishermen would be making wages if working at nonfishing jobs so, for determining costs and profits, fishermen's wages while fishing were calculated at $20 per day with no allowance for overtime and were then included in the expense of operation. Profits, as used here, would be the amount over and above all expenses, including wages. According to the costs just given and the fishing schedule in Table 3, the calculated cost of operating the entire fleet for a year would be $323,000 (Table 4).

Salmon are high-priced fish. The public has always been willing to buy the entire California catch and usually additional tonnages that are imported into the State as well. Since our hypothetical fishery will be operating in the future and because its costs are all based on current prices, I have used the latest price figures available in detail, i.e., those of 1959. The 1960 prices were higher, but I lack full details.

TABLE 4
Cost of Operating a 50-Boat Fleet

Item		*Cost*
Boat, other than fuel		
Hull $6,000; useful life 20 years; sale value $1,000; cost per year	$250.00	
Motor $1,500; useful life 10 years; turn-in $300; cost per year	120.00	
Boat and motor maintenance, cash outlay per year	300.00	
Fisherman's time on maintenance, 20 days per year at $20 per day	400.00	
Net		
Purchase price $1,500; useful life 1½ years; cost per year	1,000.00	
Fisherman's time spent maintaining net, 20 days at $20 per day	400.00	
Total per boat other than fuel or wages of fisherman while fishing, per year	$2,470.00	
Total cost of fleet of 50 boats, per year		$123,500.00
Fuel, 230 boat-months at $150.00 per boat-month—total per year		34,500.00
Wages of Fishermen (exclusive of maintenance) 330 man-months at $500 per 25-day month		165,000.00
TOTAL COST OF OPERATING FLEET OF 50 BOATS, PER YEAR		$323,000.00

TABLE 5
Income and Profit from the Hypothetical Fishery

Average gross income:	
7,895,000 lbs. of salmon at $0.421 per lb.	$3,324,000
Less: Total cost of operating fleet (*see* Table 4)	323,000
POTENTIAL NET PROFIT	$3,001,000
Potential net profit per pound of salmon landed	$0.38
Potential net profit per fish landed	$8.45

The 1959 salmon catch was landed entirely by trollers who, in 1959, received an average of $0.468 per pound for their fish. Traditionally, gill-net caught fish sold for a trifle less than troll-caught fish, because as soon as salmon leave the ocean some begin to lose their silvery color and take on spawning colors. To determine the ratio between troll- and gill-net fish prices, the average received for each was compared during the last five years of the gill-net fishery. Gill-net fish sold for as little as 75.5 percent of the troll fish price-per-pound in 1955 and as much as 99 percent in 1954. The five-year average was 90 percent. At this rate, the 1959 catch would have been worth 0.9 times $0.468, or $0.421 per pound. A 7,895,000-pound catch would have sold for about $3,324,000. The fishermen would have received roughly $3,000,000 over and above their boat operation costs and their wages of $20 per day (Table 5). This is the equivalent of a profit of 38 cents for each pound of salmon landed, or about $8.45 per fish.[7]

These are the profits a 50-boat fleet could have made if the operators had owned and harvested the Sacramento-San Joaquin salmon runs much as a farmer owns and harvests crops grown on his land. With appropriate adjustments as prices change, these figures can be used to calculate net benefits to commercial salmon fisheries if a water or power project is able to enhance existing salmon runs or establish new ones.

This method takes no account of sportfishery values. In making the calculations it was assumed there would be a sportfishery in addition to the hypothetical commercial fishery just as there is a sportfishery in addition to the existing commercial fishery. Sport values would, therefore, be in addition to commercial values.

SUMMARY

When water or power projects might damage a fishery, it is not necessary under California and federal law to determine the dollar value of the threatened fishery, to obtain fishways or hatcheries, or in other ways maintain the fishery at its natural preproject level.

To obtain funds to enhance a fishery, it is necessary to show the value of extra fish produced will exceed the cost of producing them.

The methods presently used to evaluate commercial fisheries are varied, and none is directly comparable with methods used to calculate the value of other beneficial uses of water.

[7] According to Cope and Slater (1957) the average weight of a gill-net caught salmon was 22.23 pounds during 1947-1949.

The net-economic-yield concept is not applicable to a fishery in which everyone can participate and in which efficient methods are outlawed to prevent overfishing. The concept could be applied, however, in a fishery managed for maximum efficiency. The profits that would accrue from such a fishery are calculated.

The troll fishery, now the only legal way to take commercial salmon in California, is very inefficient. Several other fishing methods are briefly considered and costs are calculated for operating a hypothetical gill-net fleet in the Sacramento-San Joaquin Delta. (It is not proposed that gill netting be legalized—the study is strictly for calculating profits.)

In such a hypothetical fishery all trolling would be stopped, all fishing for Sacramento-San Joaquin salmon would be in the Delta. Similar fisheries could be established in other rivers.

The historical gill-net fishery was outlawed in 1957 after its efficiency had been reduced by overcrowding, closed seasons, and closed areas. It could take only those fish which escaped the trollers.

The harvest in the Delta could be at least as large as the total ocean salmon catch off California because, landings of Sacramento-San Joaquin salmon presently made off Oregon, Washington, and Canada exceed catches made off California of salmon from all other rivers. California's 7,895,000-pound average annual catch (1952-1961) was used as the normal catch of the hypothetical gill-net fleet.

The probable monthly distribution of the catch was determined from gill-net catch records and from some experimental fishing during the closed season.

The largest gill-net catch for which we have detailed records was made in 1946 when 6,463,000 pounds of salmon were taken. The season closed September 26 when fishing was at its peak. In September, 219 boats were fishing, including a number of unsuccessful ones. The fishing grounds were seriously overcrowded and the fishermen were using linen gill nets which were pulled by hand. By doing away with lengthy closed seasons and by using nylon or monofilament nets (which have been proven much more effective) and mechanical net pullers, a fleet of 50 boats manned by good fishermen could land the same poundage. The 50 boats would be needed only during the peak months of September and October.

The cost of purchasing, maintaining and operating such a fleet would be about $323,000 per year, including $20 per day for time spent by each fisherman either while fishing or doing maintenance work.

The gross income at 1959 prices, about $3,324,000 per year, would yield a net profit of over $3,000,000 which is the equivalent of 38 cents per pound or $8.45 per fish landed.

Thus, 38 cents per pound or $8.45 per fish would be a justifiable amount to allow when calculating net benefits to the commercial salmon fishery that would result from enhancing existing runs or establishing new ones.

Values of the sport catch are not included in these determinations.

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