

## THE ECONOMICS OF OPERATING A WETFISH SEINER

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If we are going to harvest the anchovies and mackerel in the California Current region, we will have to do something about the fleet. The fleet is small, and the boats are old. With this in mind, the Operations Research Group at FOC, La Jolla decided about a year and a half ago to look into the economics of operating a wetfish seiner. We collected data on costs and earnings correlated with landings for 22 boats for the period 1963 through March 1968. Altogether I examined about 1,000 monthly settlement sheets, as well as various financial records.

Our study had three objectives: 1) to describe and document the economic condition of the fleet, 2) to construct a costs and earnings model, and 3) using the model, to examine the economic feasibility of expanding the fleet, either through recruitment of surplus vessels from other fisheries, or through new construction.

I presented a summary of the data on the financial condition of the fleet at the MRC meeting in June 1969. Suffice it to say that, as of the first quarter of 1968, the fleet was doing very poorly. Profits were very low on the average, costs were rising, and employment was falling. The data are available in a published paper (Perrin and Noetzel, 1970).

Today I will tell you very briefly about the approach we used in analyzing costs and constructing a predicting model, and I will summarize the conclusions we reached through use of the model about the economic feasibility of fleet expansion and new construction.

We wanted to predict costs, profit, return on investment, and crew earnings for various-sized vessels at various levels of revenue and various catch compositions with respect to species, and we used a straight forward reductionist approach.

We were not able to predict revenue. We could find no relationships in our data between total value of landings and vessel characteristics such as size, fish capacity, or horsepower. We can think of several possible reasons for this. More often than not, the boats are not fully loaded, or even half loaded, when they come in, especially when they are fishing mackerel, bonito, or tuna. This could be expected to reduce the effect of differential size. Most of the fishing is very local, often within 8 or 10 miles or less of port. This would reduce the effect of differential speed. Another possibility is that skill is an over-riding factor. Setting a purse seine requires a great deal of skill, and some captains are certainly better at it than others.

Still another possibility, of course, is that we had insufficient data. We had no effort data correlated with landings. California Fish and Game has now collected such data, and perhaps between-vessel dif-

ferences correlated with vessel characteristics will become visible after landings have been standardized to effort.

Since we could not predict revenue, we instead predicted costs, profit, etc. at arbitrary levels of revenue over a range including all levels achieved by boats in the fleet in the past and hypothetical higher levels.

In other words, the approach we used was to say, "What would be the costs, profit, return on investment, and crew share for a 150-ton capacity boat landing \$100,000 worth of mackerel? What would they be if the landings were half mackerel and half anchovies, or if it were a 100-ton capacity boat, and so on."

Since we are interested in the feasibility of new construction, we asked the questions for hypothetical new vessels, as well as for old vessels of the type now in the fleet.

First, we had to analyze costs. The costs are of two major types; so-called "trip expenses" and "owner costs." Trip expenses are deducted from the gross revenue, and include fuel, oil, salt, ice, airplane spotting, and contributions to the welfare fund, the pension fund, and the patrol agency. Rather than subdividing trip expenses in our analysis, we attempted to relate them *in toto* to amount and species composition of the landings, using the data from the monthly settlement sheets. We did a multiple regression on the data for 1967:

$$Y = 914 + 0.00103X_M + 0.00519X_T + 0.00399X_B + 0.00038X_A$$

where  $Y$  = estimated trip expenses for one settlement period, 914 is the  $Y$  intercept,  $X_M$  = pounds of mackerel,  $X_T$  = pounds of tuna,  $X_B$  = pounds of bonito, and  $X_A$  = pounds of anchovies landed. All the coefficients are significant at  $P$  = less than 0.001, and the regression accounts for 75% of the variance. Since we are concerned more with dollars than with pounds, we restated the relation for the annual case as follows:

$$Y = 8,052 + 0.0275 X_M + 0.0419 X_T + 0.0939 X_B + 0.0380 X_A$$

where 8,052 = the intercept for the single settlement case multiplied by 8.81, the average number of settlements per year;  $X_M$  = the value of mackerel;  $X_T$  = value of tuna;  $X_B$  = value of bonito, and  $X_A$  = value of anchovies. This says that, per dollar's worth, bonito are the most expensive to catch, tuna and anchovies cost about the same, and mackerel is the least expensive to catch.

$$\text{For anchovies: } \frac{\text{cost}}{\text{value}} = \frac{\$0.00038/\text{lb.}}{\$0.01/\text{lb.}} = \frac{\$0.038}{\$1}$$

So now we can estimate the trip expenses attached to a particular level of revenue and a particular catch composition.

After trip expenses are deducted from the gross revenue in a settlement, the remainder is split between the owner and the crew. In the San Pedro fleet, the owner's share ranges from 36½% to 41½%, depending on the size of the vessel. The owner pays the so-called "owner's costs" out of his share. In our analysis of owner's costs, we used the following categories: parts and repairs, netting and supplies, insurance, payroll taxes, interest, moorage, state and county taxes, depreciation, and a miscellaneous category. For some of these submodels, such as insurance and depreciation, we used deductive methods, for others, such as parts and repairs and netting and supplies, we fell back on empirical equations derived from our data. Most of the estimations are dependent on the characteristics of the vessel and on the level of revenue. Only one, that for netting and supplies, depends on the composition of the catch; it increases by \$2 per ton of fish landed, which obviously is quite important when considering anchovy fishing. We had no data for repair costs for new wetfish boats, so we used data for new shrimp boats of comparable size in the Gulf of Mexico.

We then used the cost estimators and predicted profit, return on investment, and crew share for old and new boats, varying vessel capacity from 70 to 150 tons for old boats and 66 to 264 tons for new boats, the gross revenue from \$50,000 to \$250,000 in increments of \$50,000, and the catch composition from that of the 1967 landings through 100% mackerel, ½ mackerel and ½ anchovies, and 100% anchovies. There are sample calculations and summary tables in Perrin and Noetzel (1970).

The conclusions we reached based on these calculations were pretty much what we expected. For the old boats, we found a dichotomy of interest between the vessel owner and the crew with respect to vessel size. The highest crew share at any level of revenue is with the smallest vessel, whereas the highest profit is with the largest vessel. Crew share is most affected by vessel size, but profit is most affected by composition of the catch.

For example, the maximum effect on profit at \$200,000 revenue is about \$13,000; this is the difference between an all-anchovy catch and an all-mackerel catch. The best situation, given existing boats, from the standpoint of profit is a 150-ton boat taking an

all-mackerel catch. The best from the standpoint of the crew is a 70-ton boat taking a ½-mackerel ½-anchovy catch, by value. The break-even point for a 150-ton old vessel ranges from \$65,000 for an all-mackerel catch to about \$90,000 for an all-anchovy catch. These amounts are well within the range of gross revenue attained in the past. Because the market value of these old boats is very low, high return on investment can be attained with comparatively low profits. So we concluded that, given favorable market conditions, it would be feasible to expand the fleet under present conditions of catch rates and fish prices, using surplus vessels from other fisheries. This, of course, is saying nothing about stock sizes or availability, or about institutional barriers.

The outlook for new construction is a different matter. The break-even point for the optimum boat with a 50% construction subsidy, and with a catch composition similar to those of the past, is about \$150,000, which is close to the upper end of the range of gross revenue in recent years. In order to make a profit comparable to the profit made by top boats in the present fleet (about \$30,000), gross revenue of about \$225,000 would be required. For an all-anchovy catch, the figure would be closer to \$275,000. \$275,000 worth of anchovies at \$20 per ton is 13,750 tons. For a 100-ton boat, this would mean a full load every 3 days or less on a sustained basis all year, which probably is impossible. We concluded that unless fish prices or catch rates go up considerably, new construction is not advisable, at least under the present share-out system.

The reason for this is the high investment base. A new 100-ton boat would cost about \$200,000, while the average market value for the present fleet is only about \$50,000. This difference causes very high increases in insurance, depreciation, and interest, even with a subsidy.

If the share-out schedule were revised, things might be different. A 66-ton new boat could make a \$20,000 profit, or about 10% return on total capital, with an all-anchovy catch worth \$150,000 (about 7,500 tons), if the boat's share of net proceeds were 55%, instead of the 37½% it is now. With a crew of seven, the crew share would be about \$8,600.

Looking to the future and the systems approach, we have programmed our costs and earnings model, and it is ready to integrate with a production model, being developed by Dr. Lenarz in our laboratory, and a demand model; so that we can carry out bioeconomic simulation studies of the wetfish industry.

## REFERENCES

- Perrin, William F., and Bruno G. Noetzel. 1970. Economic Study of the San Pedro Wetfish Boats. *Fishery Industrial Research*, 6(3): 105-138