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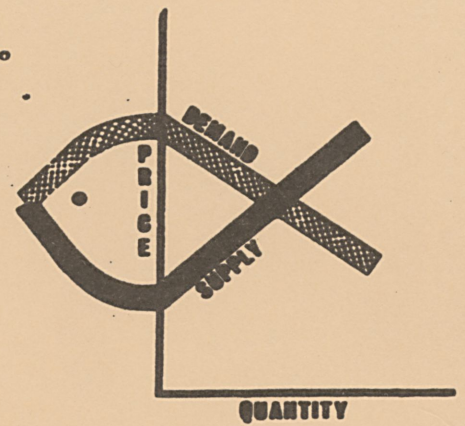
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OF CHANGES IN THE HARVESTING LABOR
FORCE IN THE MAINE LOBSTER INDUSTRY

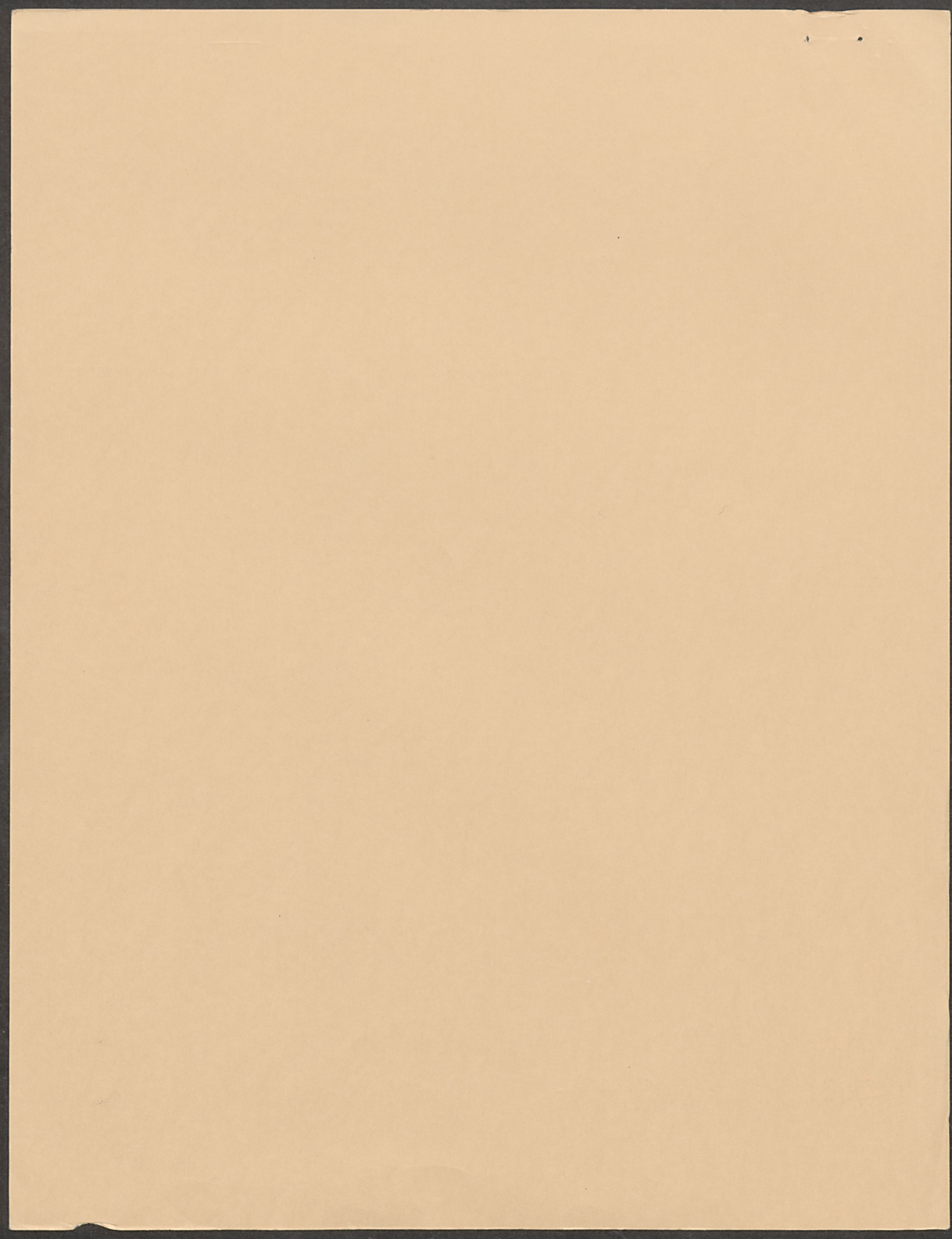
by

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U.S.
NATIONAL MARINE FISHERIES SERVICE
ECONOMIC RESEARCH LABORATORY



FINAL REPORT

A STUDY OF THE SOCIO-ECONOMIC IMPACT
OF CHANGES IN THE HARVESTING LABOR
FORCE IN THE MAINE LOBSTER INDUSTRY

(Contract No: 14-17-007-1121)

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I. INTRODUCTION: THE PROBLEM

It is hardly debatable that common property ocean fishery in general is characterized by economic inefficiency in terms of suboptimal utilization of resources. "Any discussion of the economics of the high sea fisheries," wrote Dr. Crutchfield, "would appear grossly out of place in meetings geared to the theme of efficiency. Among the resource oriented industries (a group studded with exceptions to general rules about economic maximization) the fisheries stand out as a most recalcitrant performer."¹ The lobster fishery is cited as a typical illustration of economic inefficiency. In particular, it has been recognized that unlimited entry to a common property resource such as the lobster produces excess capacity and consequently suboptimal conditions of production. This excess capacity is reflected in boats and gear, fishermen, and storage and transportation facilities. Such excess capacity may result, as pointed out by Dr. Pontecorvo, with or without closed season.² The theme of economic inefficiency and excess capacity invariably raises the question of entry which economists use as one of the criteria to judge market imperfection. As observed by some writers, the industry is characterized by "over-capitalization, inefficiency, inferior quality, market instability, lack of fiscal control, nonrestriction of entry into

¹James Crutchfield, "The Marine Fisheries: A Problem in International Cooperation," American Economic Review, May 1964.

²G. Pontecorvo, "Regulation in the Northern Lobster Fishery," FAO Fisheries Reports No. 5, 1962.

the fishery, and inappropriate and unscientific regulations..."³

In Maine, two-fifths of the annual yield, on the average, is captured in the two months of August and September and two-thirds of the annual volume is produced in the one-third of the year from July through October. This seasonal concentration of output is attributed to the catchability of lobsters during this period and to the seasonal entry of fishermen. The favorable summer and early fall weather coupled with sheltered inshore fishing grounds permits entry with minimal equipment. Entry of this sort invariably results in excess capacity. In 1969 there were nearly 6,000 licensed lobster fishermen who caught nearly 20 million pounds of lobsters for the year. In view of the fact that less than a third of these licensed fishermen could be considered full-time, the number of fishermen is far in excess of what is needed to produce the realized annual output. As estimated by one expert, "in all probability, a thousand full-time fishermen could catch just as many lobsters as 6,000."⁴ By implication, the present population of lobstermen, under present conditions of practically unrestricted entry, may illustrate what economists term "disguised unemployment" or under-employment.

The search for greater efficiency in exploiting this important marine resource has triggered investigations into alternative management

³Robert L. Dow, Phillip L. Goggins and John Hughes, The American Lobster, Marine Resources of the Atlantic Coast, Atlantic States Marine Fisheries Commission, Florida, October 1966.

⁴Robert L. Dow, "Problems Influencing Use of Renewable Marine Resources," Maine Law Affecting Marine Resources, 1970. Dr. Dow defines a full-time fisherman as one who purchases the license between January 1st and the end of April.

strategies that are likely not only to conserve the renewable fishery resource but also optimize the use of other scarce factors such as capital and labor.⁵ One such strategy focuses on limiting entry to the resource in order to maximize "net economic yield." The doctrine of maximum net economic yield has been stated by Christy and Scott as follows: "The goal of economic efficiency can be approached by preventing excessive entry into the industry, so that those who fish would be producing the maximum net economic revenue (to be shared by them or appropriated by the public) and so that those who are prevented from participating will be able to produce other goods and services valued by the community."⁶ This doctrine rests on two alternative assumptions: (a) the gain to the industry would be more than sufficient to compensate all those who lost and such compensation would actually be paid; or (b) compensation would not be necessary because society would swiftly and painlessly adjust by transferring those who lost to equally or more attractive jobs elsewhere. It is not difficult to see that these assumptions may be seriously questioned in the real life environment. Especially when a doctrine such as this has definite implications for policy and alternative management strategy, such questions must be

⁵See, for instance, Frederick W. Bell, Estimation of the Economic Benefits to Fishermen, Vessels and Society from Limited Entry to the Inshore U.S. Northern Lobster Fishery, Working Paper No. 36, Bureau of Commercial Fishery, March 1970.

⁶Christy, F. M. and A. Scott, The Common Wealth in Ocean Fisheries, Baltimore, John Hopkins University, 1965.

raised. As a minimum, there should be some understanding of the feasibility and magnitude of compensation and other forms of adjustment that will be needed if entry is limited.

In any discussion of alternative management strategies (e.g. limited entry) that might affect the labor force in a given industry such as the lobster fishery in Maine, it is important to examine the socio-economic repercussions of the contemplated change. One must, for example, investigate whether alternative employment would be available to those fishermen who will be excluded because of limited entry; their employability (and trainability) relative to the local labor market, their geographical and occupational mobility patterns, the adaptability of their skills, alternative income earning possibilities ("salvage value" of displaced labor), the potential for upgrading their existing skills and for the acquisition of new skills, the barriers to their mobility including sociological, psychological and economic variables are some of the crucial elements to be carefully considered.

Furthermore, the policy-maker has to evaluate the potential impact on the local and regional economy in terms of shifts in income and employment and associated fiscal consequences including welfare expenditures and changes in tax revenue. Finally, it would be important to examine how limited entry in a given fishery such as lobster fishery might affect other fisheries such as shrimp and scallop fisheries. In a comprehensive study, all these questions need to be investigated before any definitive conclusions can be reached. However, the present study is of much more limited scope and pertains to only some of these questions bearing on limited entry.

This study focuses on the possible socio-economic impact of a hypothetical reduction in the harvesting labor force in the Maine lobster fishery. As to how this reduction is or can be brought about is outside the scope of the study. The study utilizes the data obtained from a sample survey of 131 fishermen from three selected communities. The problem posed for investigation was simply this: if a group of fishermen from this sample is excluded from lobster fishing based on some specified criterion, what sort of socio-economic impact can be expected? Can certain indicators be developed to measure such impact in order to consider alternative management strategies? For this purpose, it was considered desirable to (a) introduce the notion of a target group composed of fishermen regarded as candidates for limited entry and (b) to develop alternative criteria for the construction of a set of target groups rather than singling out one specific target group.

Constrained by time and resources available for this project, the study addressed itself only to selected dimensions of socio-economic impacts of limited entry into the Maine lobster fishery. It is to be clearly understood that some of the findings of this study, because of its very limited scope, are essentially for illustrative purposes rather than for use as supportive materials for or against any implicit management strategy that may be suggested by the format of the target groups.

II. OBJECTIVES

The major objective of the study is to present an evaluation of the socio-economic impacts of limited entry into the Maine lobster fishery. A complete evaluation may include but not be limited to the income and employment effect on the displaced fishermen, income effect on the surviving fishermen, income and fiscal effect on the local and regional economy, effect on other fisheries and so on. However, for reasons stated above, the limited objectives of this study are:

1. To make an appraisal of the employability and alternative income earning possibilities of displaced labor.
2. To derive some measures of social impact in terms (a) income effects and (b) income maintenance burden associated with displacement because of limited entry.

III. RESEARCH DESIGN

The study was designed as a small-scale pilot effort, concentrated on three typical communities rather than encompassing the entire Maine lobster fishery. These communities are: Phippsburg, Beals, and Corea. The selection was made in consultation with the Maine Department of Sea and Shore Fisheries and the National Marine Fisheries Service. The existence of some contrasts in the structure of the local economy and the relative importance of lobster fishery in their economy weighed heavily in the selection process. Corea represents a highly specialized, isolated economy where lobstering is the predominant economic activity. Beals is also highly specialized but less isolated than Corea. Phippsburg's economy is more diversified and in close proximity to sources of alternative job opportunities. Each of the areas has one feature in common: the lobster fishery is a major economic activity.

It is difficult to say how representative these three communities are of the entire lobster fishery. Sufficient information is not readily available to identify the economic characteristics of the population of lobster fishermen in Maine and relate them to those of the sample fishermen in these communities.

For the purpose of the study the following hypotheses were formulated for investigation:

1. Limited entry will exclude a certain fraction of the lobster harvesting labor force that will be otherwise unemployable. (Alternative hypothesis: a significant fraction of displaced labor because of limited entry will be employable, given the conditions

in the local labor market, the type of skill possessed, the potential for adapting skills to job market requirements, the availability of retraining opportunities, motivation for training and mobility and so on.)

2. Displacement of labor because of limited entry may adversely affect the local economy because of loss of income from lobstering not being compensated for by income from alternative jobs and from additional lobstering by surviving fishermen, and because of loss of income from lobstering on the part of those who are not in the labor force.

To generate the information needed for this investigation, a stratified random sample of 131 fishermen was selected. This size of the sample depended essentially on the estimated cost per interview and the budgetary constraint. The allocation to each stratum was strictly according to proportion of fishermen in each community to the total number of fishermen of all three communities. The survey data was supplemented by information on local labor market obtained through the cooperation of the regional offices of the Maine Employment Security Commission.

For the survey, a structured questionnaire was developed and pre-tested. Using the modified questionnaire and personal interviews, the survey was completed in six weeks. The response rate was better than 90 percent.

The survey resulted in a large volume of information on the sampled fishermen. The following broad categories of information may be identified:

TABLE 1

Fishing Effort by County

County	Percentage of fishermen	Percentage of effort*	Average days/month	Average mos./year	Average traps	Average trap-days
Washington	11.8	9.3	20.8	6.3	162	16,900
Hancock	21.2	28.2	19.2	7.0	158	28,800
Waldo	1.5	.1	16.0	5.4	57	9,200
Knox	19.6	20.5	19.1	7.2	131	22,700
Lincoln	12.9	9.5	19.7	6.2	115	16,000
Sagadahoc	4.5	2.5	20.9	5.6	99	12,000
Cumberland	17.4	25.1	19.9	5.6	156	31,100
York	9.1	4.8	19.8	6.6	95	11,300
Inland Counties	2.0	.1	16.6	4.7	72	6,000

*Percentage of effort for each county is computed on the aggregate number of trapdays fished by all of the fishermen in that county.

Table 1 contains several interesting pieces of information. A commonly recognized fact in the industry is that effort is more concentrated in the west than in the east. This table disproves this conception. As can be seen, Hancock County, to the east, yields more effort than any other county. However, Cumberland to the west also exerts a high percentage of effort. The interesting fact is that the two counties are similar in almost every respect. They comprise between them over fifty percent of the total effort, but are from opposite ends of the coast. The astonishing fact is that with the same effort, fishermen in Hancock County (5,258,600 lbs.) are able to land nearly double the lobster poundage of the Cumberland County fishermen (2,868,000) The value of the landings is also nearly double. (Hancock \$4,260,000 lbs; Cumberland \$2,287,000)*

*Maine Landings, 1969, U.S. Department of the Interior, Bureau of Commercial Fisheries. pages 3.9. and 10.

IV. ANALYSIS

1. The Maine Lobster Fishery: Some Basic Facts

The lobster industry in the State of Maine landed 19.8 million pounds of lobster in 1969. This accounted for 10.4% of the total fish and shellfish landings for that year. In terms of value landed, the lobster industry contributed significantly more than the rest of the fisheries, accounting for 16.1 million dollars of the 27.5 million for total catch of fish and shellfish. Lobsters thus accounted for 58.3 percent of the total value landed.⁷

There were 5750 lobster licenses issued in the State in 1969. These 5750 lobstermen fished a total of 805,375 traps or approximately 105.7 million trap-days during the year 1969. The gross earnings per unit of effort was \$.18 per trap-day. This value is arrived at by adjusting Maine landing up by 16 percent, a factor arrived at by Robert Dow to include landings not reported. This produced total landings of 18.7 million which were divided by total trap-days yielding the return of \$.18 per trap-day. The average gross income was approximately \$3,000. The total investment in gear (i.e., boats, traps, bouys, etc.) is about ten million dollars.⁸

There have been fluctuations in the number of licenses issued over the past 10 years. The following table illustrates a seemingly

⁷Maine Landings 1968-70, U. S. Department of the Interior, Bureau of Commercial Fisheries, Page 3.

⁸Information supplied by Robert Dow, Research Division, Maine Department of Sea and Shore Fisheries.

cyclical pattern of lobster licenses, showing a high of 6472 in 1961, a low of 5425 in 1967, and another high of 6316 in 1970.

TABLE 1

Number of Lobster Licenses Issued in Maine 1971-1970

Year	Number of Licenses	Year	Number of Licenses
1961	6472	1966	5613
1962	5658	1967	5425
1963	5695	1968	5489
1964	5803	1969	5750
1965	5802	1970	6316

Source: Maine Department of Sea and Shore Fisheries

The age distribution of the population is as follows:

TABLE 2

Age Distribution of Lobster Fishermen 1968

<u>Age</u>	<u>No.</u>	<u>%</u>
<15	481	8.8
15-19	640	11.7
20-24	480	8.8
25-29	439	8.0
30-34	436	8.0
35-39	433	8.0
40-44	492	8.9
45-49	495	9.0
50-54	473	8.6
55-59	344	6.3
60-64	310	5.7
65 +	439	8.0
TOTAL	5489	100.0%

Source: Maine Department of Sea and Shore Fisheries

The communities chosen for study--Phippsburg, Corea and Beals-- represent 277 fishermen or 4.4 percent of the 6316 fishermen licensed in 1970. A sample of 131 of the fishermen were randomly selected by community as follows:

TABLE 3

Distribution of the Sample Fishermen by Communities		
Communities	Total Fishermen	Sample
Beals	137	61
Corea	73	27
Phippsburg	67	44
TOTAL	277	131

61
131

The geographical location of these three communities are shown in the attached map of the State of Maine.

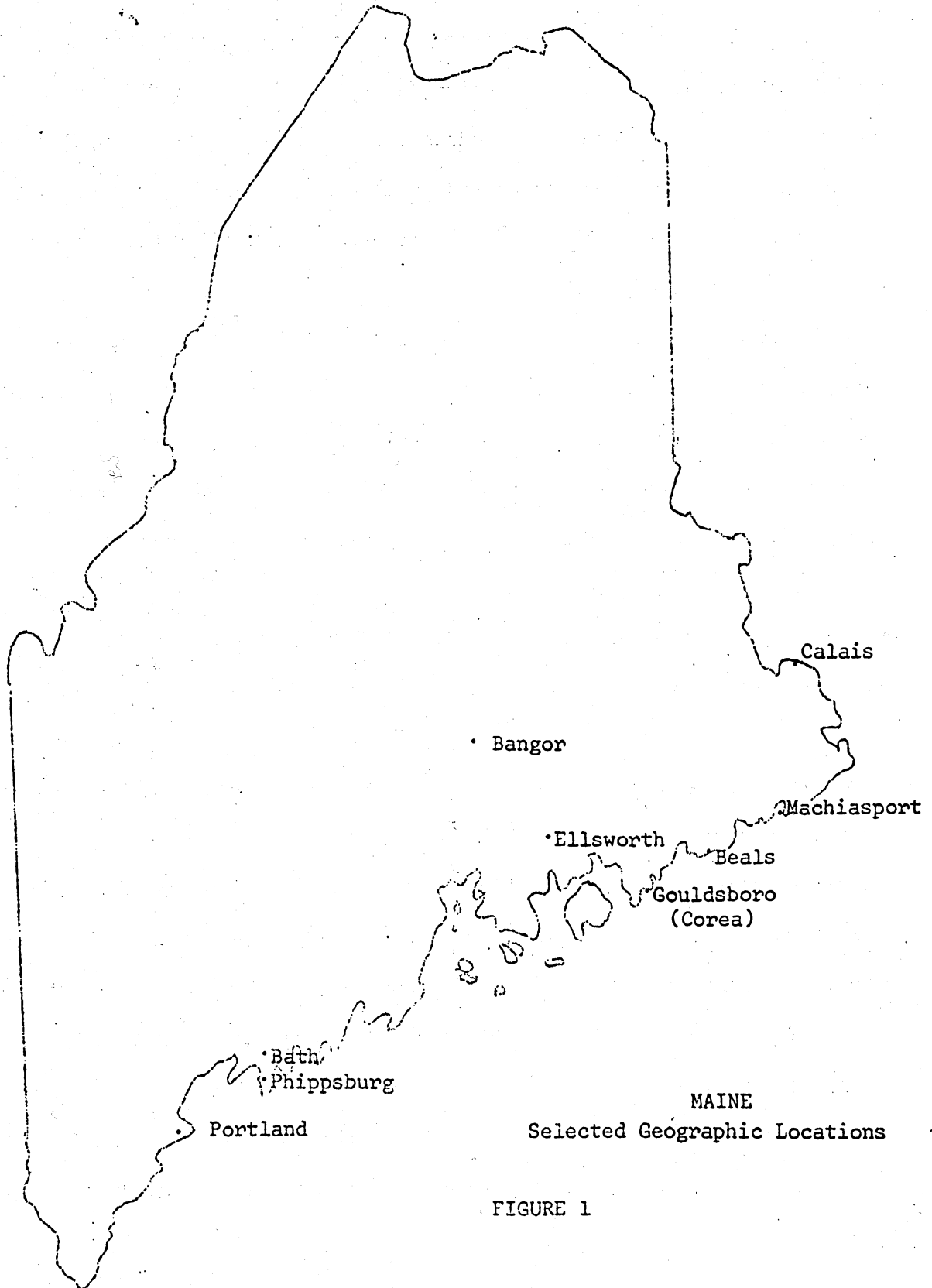


FIGURE 1

2. Economic Profile of the Sample Communities

A. Beals

Beals is an island community of 658 persons located across Moosabec Reach from Jonesport, Maine, population 1337. (1970 Census-- Preliminary Report, Population Counts for States) The two communities-- Beals and Jonesport--are integrated as a labor market but have separate political identities. The only administrative connection between the towns is a shared high school.

Employment opportunities are limited to the fishing industry and service industry occupations. The Department of Sea and Shore Fisheries issued 142 lobster licenses to the residents of Beals in 1969. Other licenses include worms--52, and clams--89. Many of the fishermen hold more than one license. No license is needed for shrimping.

Businesses on Beals include seven lobster pounds, most of which are family owned and operated. The pounds are used to store lobsters until market prices increase and the pound may be filled by the family owning it or the pound operator may become a dealer for part of the year buying from fishermen until he has the pound stocked. A third use of the pound is leasing to a full-time dealer for his own stocking activities. If the family does not operate the pound on a part-time basis, the employment provided rarely exceeds one job. The two full-time lobster deals on Beals employ between two and four laborers each. The twelve boatyards are father and son operations although occasionally one non-family employee may be hired. The two clam shops on the island employ a total of between twenty-five and thirty persons together--mainly women who shuck clams for shipment

outside the area. The service industry employment available on Beals consists of jobs in three general stores, one garage, one oil company, one television and radio sales, the local elementary school, and various part-time jobs available in the town government (mostly elective positions).

The grocery stores employ about ten people full-time and another five or six part-time. Most of these people are members of the family owning the store. The garage, oil business, and television sales employ no more than six people. The school system employs seven teachers, a janitor, a bus driver, and an attendance officer. Other employees of the school system include a superintendent, secretaries, a supervisor, and school board members.

In Jonesport employment opportunities are in much the same industries as they are in Beals. Ninety-nine lobster licenses, 60 worm licenses, and 81 clam licenses were issued by the Department of Sea and Shore Fisheries. Employment opportunities available in Jonesport include jobs in one restaurant, one bank, one sardine factory, two grocery stores, one clothing store, one drug store, four gas stations, three gas or oil companies (total employment each is no more than three), one dentist office, one doctor's office, two lobster dealers and a lobster cooperative which has four employees.

Other firms in the area providing substantial employment are two sardine factories--one in Milbridge and one in Machiasport. This employment is part-time and seasonal.

The town government of Beals consists of three selectmen and overseers of the poor, three assessors, a town clerk, a treasurer, a three-man board of education, two attendance officers, a tax collector, a road commissioner, two constables, a health officer, and a chimney inspector.

The 1969 value of product given by the Census of Maine Manufactures 1969 for Beals is \$283,258, the total gross wages are \$70,856, and average gross wage is \$2,443. These figures are for manufactured products only and do not include income from lobstering, shrimping, or other fishing unless the catch has been processed in some manner. Total employment in these industries is given as 29. For Jonesport the corresponding figures are value of product--\$681,509, gross wages--\$192,495, and average gross wage--\$2,406. Total employment was 80.

Total assessed value of property on Beals in 1969 was \$237,560. The town budget shows total receipts of \$99,376, and total expenditures of \$73,910, of which about \$55,000 was for wages distributed to inhabitants of the town.

TABLE 4

Occupational Distribution of the Work Force in Beals, 1960

	Male	Female	Total
Professional	8	8	16
Clerical	15	4	19
Craftsmen	28		28
Operatives	17		17
Service		4	4
Laborers (farm)	11		11
Laborers	77		77
TOTAL	156	16	172

Source: 1960 Census Special Tabulation for Maine Employment Security Commission. Approximately 90 percent of the "laborers" may be classified as lobster fishermen.

B. Corea (Gouldsboro)

The community in Corea is part of the township of Gouldsboro. The 1970 population of Gouldsboro is 1270, an increase of 170 people over the 1960 figure of 1100. In 1960 there were 363 households. There were 420 males over 14 years of age and 406 females.

Corea's major industry is lobster fishing. There are other sources of employment but lobster fishing, providing some 70-80 jobs, is the largest employer of the working men. Other types of fishing include seining, clamming, and worming. It is difficult, however, to get employment figures for these types of jobs as the people who do this type of work may only do it part-time or to supplement lobstering. There are some nine stores in the town which are all family run. These stores provide at the most two-three jobs each for people in the immediate family. There is also a boatyard which employs six-seven people year round. A fish cannery is the town's second largest industry with a full-time employment of 30 and a seasonal employment of another 170. These are primarily low pay piece work jobs processing fish. The other industry located in Gouldsboro is a naval satellite tracking base. This base employs forty civilian workers, four of which are professionals, fourteen technicians, and the remaining are maintenance workers. There are also eight teachers employed by the town's elementary school.

TABLE 5

Occupational Distribution of the Work Force in Gouldsboro, 1960

	Male	Female	Total
Professional		4	4
Managers	21	14	35
Clerical	4		4
Sales	8	9	17
Craftsmen	50		50
Operatives	9	17	26
Private household	8	8	16
Service	5		5
Laborers	137		137
No information	33	9	42
TOTAL	275	61	336

Source: 1960 Census Special Report for Maine Employment Security Commission. Approximately 90 percent of the "laborers" may be classified as lobster fishermen.

C. Phippsburg

In 1960 the population of Phippsburg was 1121. The 1970 population is 1180, an increase of 59 people. Of the 1121 people listed in April of 1960, 397 were in the labor force, 358 were employed, and 39 were unemployed. Of those over 14 years of age, 394 were men and 403 were women. There were 335 households.

Phippsburg's major industry is the summer tourist and summer resident trade. At Phippsburg there are several large tenting grounds, a state park, a large resort, and many summer residences located on its several miles of ocean frontage. Other local industries include fishing, which consists of a fish factory, several large offshore fishing boats and a fleet of lobster boats. There are also two small construction companies that build and repair summer homes. The bulk of

Phippsburg's employed population, however, commute to other towns and cities for employment. Probably the largest employer of Phippsburg people is Bath Industries located in the adjacent city of Bath.

TABLE 6

Occupational Distribution of the Work Force in Phippsburg, 1960

	Male	Female	Total
Professional	8	4	12
Farmers & farm managers	4		4
Managers	16	11	27
Clerical	4	20	24
Crafts	68		68
Operatives	60		73
Private household			20
Services	12		12
Farm labor	12		12
Laborers	71		71
Others	27	8	35
TOTAL	282	70	358

Source: 1960 Census Special Report for Maine Employment Security Commission. Approximately 80 percent of the "laborers" may be classified as lobster fishermen.

3. Selected Socio-Economic Characteristics of the Sample Lobstermen

Average age of the lobstermen in the sample is 42.6 years. There are 15 below the age of 19 and 18 in the age bracket 65 and over. The median income for the group is \$5,280 and average income is \$6,213. There are 13 fishermen with income less than \$1,000 and 15 with income over \$14,000. Of the 118 fishermen who gave reasons for lobstering, 33 (which includes 3 students) responses may be categorized as "economic" and the rest "non-economic" including home consumption, preference for the particular way of life, influence of family and so on.

Of the 109 fishermen who supplied information on number of traps,

slightly over 50 percent owned less than 300 traps; 23 fishermen owned more than 500 traps. Of the 93 fishermen who gave information on investment in trap gear approximately 50 percent had investment of less than \$2,000; only 3 had investment of \$8,000 and over. The average years of education was 9.8. Approximately 40 percent had less than 9 years of education. Of 131 fishermen, 41 indicated that they received some type of formal vocational training in areas including carpentry, metal working, mechanic, professional and clerical work. Of 81 fishermen when asked about preference for receiving vocational training, 63 indicated no preference. Only a small fraction expressed preference for training in electrical, professional and carpentry work.

Among the 109 fishermen who supplied information on income from part-time jobs, 77 indicated that they had little or no income from this source. Only 7 indicated that they received more than 50 percent of their income from alternative jobs.

(More detailed information on these socio-economic characteristics of the sample lobstermen is given in Appendix D .)

4. Construction of Target Groups

In order to analyze the potential socio-economic impact of limited entry, it is necessary to identify the possible candidates who might be considered targets for limited entry or any other management strategy that might affect the harvesting labor force. In the absence of historical data, for the purpose of this study, four groups have been constructed, using alternative criteria. It is not intended that the groups be mutually exclusive.

The criteria variables chosen for this analysis include the following: income, investment, effort and income/effort ratio. It should be noted that with the exception of one target group, combinations of criteria variables were used to define the target groups. Admittedly, similar groups could be constructed using different criteria. The selected criteria appeared to be quite meaningful for the purpose of this study. The procedure is explained in more details below.

Target Group I was chosen on the basis of a combination of two criteria: (a) low earnings/effort ratio, and (b) low number of trap-days serving as a proxy for low income. It was somewhat arbitrarily decided that to be eligible for this group a fisherman had to have an income/effort ratio of less than .3 and had to fish less than 30,000 trap-days per year. Those fishing over 30,000 traps were not included because they earned sufficient income for subsistence. The following table was especially constructed for this purpose:

TABLE 7

Distribution of Sample Lobstermen According to
Income/Effort Ratio and Trap-Days

Earning/Effort Ratio*	Trap-Days Fished Per Year								N/I	TOTAL
	5000	5001- 10,000	10,001- 20,000	20,001- 30,000	30,001- 40,000	40,001- 50,000	50,001- 60,000	60,000+		
.100	1	2	1	--	--	1	2	--	--	7
.100-.199	2	3	7	8	5	4	4	8	--	41
.200-.299	5	1	8	2	4	--	6	1	--	27
.300-.399	--	2	2	2	2	1	1	--	--	10
.400-.499	--	2	1	--	--	--	1	--	--	4
.500 +	2	--	--	--	2	--	1	--	--	5
N/I	6	1	1	2	1		1	5	19	37
TOTAL	18	10	20	14	14	7	15	14	19	131

Source: University of Maine Survey Data, 1970

* The Earning/Effort ratio was calculated by dividing the number of trap-days into gross income reported by the sample fishermen.

Forty fishermen met the conditions set for this group. As it turned out, this group had an average income/effort ratio of .182 compared to .230 for the entire sample and they fished an average number of 12,570 trap-days compared to 30,707 trap-days for the sample as a whole. Their average income was only \$2,061 compared to an average income of \$6,213 for the sample as a whole. Also noteworthy are the facts that compared to the sample as a whole, the fishermen in this group fish fewer number of days and have invested smaller amounts of capital in gear and boat. Conceivably, they could improve their economic status by investing more heavily in gear and boat and/or by fishing more days per year. However, on the basis of the facts as they stand now, this group may be considered candidates for limited entry. It seems reasonable to think that in any discussion of deliberate or planned changes in the harvesting labor force in the lobster fishery, this group with low income/effort relationship and low absolute level of income would warrant consideration. Presumably, the economic status of the remaining fishermen would improve in terms of a higher ratio of income to effort and higher absolute level of income, if this group is eliminated. Of course, one has to look at the social cost of such a change and the political feasibility of such a change. The last consideration is outside the scope of this study. Some measures of social cost are developed later in the report.

An alternative approach to the problem would be to consider only low level of productivity as measured by the low income/effort ratio, regardless of the absolute size of income. Here one could argue that shifting effort away from lobstering in this case may be socially gainful,

given possibilities for improving the income/effort ratio in alternative employments. From such a reallocation of effort as an economic resource, both the displaced fishermen as well as the surviving fishermen might benefit, as the marginal productivity of both groups are likely to increase. On this premise, Target Group II has been constructed. Those fishermen who recorded an income/effort ratio of less than .2 were considered eligible for this group. (See Table 7) Naturally, there will be some overlap between this group and Target Group I. Despite such overlap, the underlying criteria are clearly distinguishable. Again, the social cost and political feasibility of eliminating this group from lobstering may not warrant such a change. But this is beside the point at this stage of the analysis.

Different combinations of investment and effort suggest other possible approaches to management alternatives. For instance, one could identify a group that represents relatively high effort and low investment input combination; another group may represent relatively higher investment and lower effort input combination. ^{9/} The reasoning for at least considering these groups as possible target groups may be explained as follows: in the absence of any precise knowledge about the optimum combination of effort and investment, two contrasting groups--high-effort low-investment versus low-effort high-investment--might suggest alternative goals for management strategies. For instance, one might consider eliminating excessive capital versus eliminating excessive

^{9/} This approach was suggested by Dr. Adam A. Sokoloski, National Marine Fisheries Service. Ref. personal correspondence dated December 16, 1970.

capital versus eliminating excessive effort as possible goals. As a minimum, the differences in socio-economic impact of such changes should be examined. It is reasonable to assume that excess capacity exists in lobster fishery, although it is difficult to establish whether such excess capacity is due to excessive effort or excessive investment or both. Under these conditions, it seems meaningful to isolate for analytical purposes, two cases, one showing evidence of excessive effort and the other of excessive investment in a relative sense. Admittedly, the state of the art does not provide absolute measurement of excess capacity either in terms of effort or in terms of investment.

Target Group III has been constructed to reflect excessive effort in the sense that they supply a large amount of labor to their operation relative to their investment. They fish on an average 150 days per year compared to 109 days for the entire sample; their average investment amounted to \$4,410 compared to \$ 7,575 for the entire sample. As a practical device, the criteria of those fishing over 100 days per year and with investment of less than \$8,000 in gear were used to select the candidates for this group. This procedure yielded 28 fishermen.

Target Group IV represents excessive capital in the sense that the fishermen in this group have substantial investments in gear relative to the number of days per year fished. On the average they have invested \$12,410 compared to \$7,575 for the entire sample and they fish, on the average, 78 days per year compared to 109 days per year for the sample. The criteria used were to include those who have invested more than \$8,000 and who fish less than 100 days per year. The group received only 6 fishermen.

Table 8 provides the basic information from which Target Groups III and IV have been derived.

TABLE 8

Distribution of Sample Lobstermen by Investment and Number of Days Fished

Days Fished Per Year	Investment in Gear									TOTAL
	\$2000	2001- 4000	4001- 8000	8001- 12000	12001- 16000	16001- 20000	20000 24000	\$24000+	N/I	
50	10	3	--	1	--	--	--	--	3	17
51-100	16	7	8	2	2	1	--	--	2	38
101-150	3	7	8	1	4	3	2	4	--	32
151-200	--	2	5	6	2	2	1	--	--	18
201-250	--	1	2	--	1	--	1	1	--	6
N/I	--	--	--	--	1	--	1	--	18	20
TOTAL	29	20	23	10	10	6	5	5	23	131

Source: University of Maine Survey Data, 1970.

5. Socio-Economic Characteristics of the Fishermen in Each of the Four Target Groups

TABLE 9

A. Geographic Distribution

COMMUNITY	Target Groups							
	I		II		III		IV	
	No.	%	No.	%	No.	%	No.	%
Beals <u>1/</u>	18	29.5	31	50.8	16	26.2	4	6.5
Corea <u>2/</u>	7	26.9	3	11.5	3	11.5	2	7.7
Phippsburg <u>3/</u>	15	34.1	14	31.8	9	26.5	--	---
TOTAL	40		48		28		6	

1/ Beals 61

2/ Corea 26

3/ Phippsburg 44, includes 10 from Bath

Source: University of Maine Survey Data, 1970

Beals will be most affected if Target Group II is eliminated, and Corea the least. If Target Group I is considered, the impact on the three communities is comparable. Corea will be affected in the least if one focuses on Target Group III. The effect on the other two communities is about the same. Target Group IV does not affect Phippsburg but will affect the other two communities more or less the same way.

. B. Distribution by Trap-days, Income and Capital Invested

The following table presents a distribution of the lobstermen in each of the target groups by trap-days, gross income and capital invested in boat and gear.

TABLE 10

Distribution of Lobstermen in Target Groups by Trap-days, Gross Income and Capital Invested

	Target Groups				TOTAL SAMPLE
	I	II	III	IV	
Trap-Days	502,799	1,753,287	973,198	185,560	3,470,000
%	14.5	50.5	28.0	5.3	
*(#),%	(40)32.0	(48)38.4	(28)22.4	(6)4.8	(113)
Income	82,450	250,233	161,583	61,000	596,500
%	13.8	41.8	27.0	10.2	
*(#),%	(40)41.7	(48)50.0	(26)27.1	(5)5.2	(96)
Capital	97,043	332,566	123,485	74,465	833,209
%	11.6	39.9	14.8	8.9	
*(#),%	(40)36.4	(48)43.6	(23)25.5	(6)5.5	(110)

*The number in parenthesis refers to the total number of fishermen relevant to a particular category; the other number is the relevant number of fishermen expressed as a percentage of the sample.
Source: University of Maine Survey Data, 1970.

Target Group I emerges as a critical group in that its share in trap-days, income and capital investment is the lowest relative to its size in the total sample. Target Group II, also a problem group, contributes relatively more trap-days, more capital and more income

compared to Group I. However, relative to its size, its share in income and capital investment is less than in proportion. Target Group III contributes relatively more in trap-days and relatively less in capital and its income share corresponds closely to its size. Target Group IV accounts for more capital relative to size and to number of trap-days and substantially more income relative to size. For this reason, this group can hardly be considered as a target group for limited entry on the basis of income-effort relationship. However, if income-capital ratio is considered, this group does not appear to be equally efficient.

C. The following table provides average values for certain socio-economic characteristics of the lobstermen in each of the Target Groups.

TABLE 11

Comparative Average Value for Selected Socio-Economic Variables in the Sample of Lobstermen and the Four Target Groups

Socio-Economic Variable	Target Groups*				
	SAMPLE	I	II	III	IV
Family Size	3.2(122)	2.9(38)	3.6(46)	2.9(28)	3.6(5)
Age	42.4(131)	42.5(40)	44.0(48)	49.4(28)	31.7(6)
Education: years	9.8(126)	9.7(40)	9.7(48)	10.0(28)	11.0(6)
Investment (gear & boat)	\$7,575(110)	\$2,426(40)	\$6,949(48)	\$4,410(28)	\$12,410(6)
Gross income	\$6,213(96)	\$2,061(40)	\$5,213(48)	\$6,214(26)	\$12,200(5)
Months per year fished	7.2(113)	5.7(40)	8.0(48)	8.5(28)	6.6(5)
Trap-days per year	30,707(113)	12,570(40)	36,526(48)	34,757(28)	30,927(6)
Days per year lobstered	109.2(113)	87.0(40)	132.2(47)	147.9(28)	78.0(6)
Earning-Effort Ratio	.230(96)	.182(40)	.140(48)	.183(26)	.355(5)

*The number in parenthesis refers to the total number of fishermen relevant to a particular category.

Source: University of Maine Survey Data, 1970.

The average income of Group I is the lowest attributable both to low labor and low capital intensity in its operation. In contrast, Group IV has the highest average income primarily due to high capital intensity in its operation in spite of low labor intensity. Group II ranks second in average income which can be explained in terms of relatively more effort and capital used compared to Groups I and III. Group III ranks third in average income. Here the high level of effort does not offset the effect of low capital intensity. Its income-effort ratio is almost the same as that of Group I.

6. Socio-Economic Impact of Changes in Harvesting Labor Force

As pointed out earlier, the different target groups were constructed on the basis of different criteria such as low earning/effort ratio, low level of both effort and investment, high labor and low capital input combination, and higher capital and lower labor input combination. The rationale for this procedure is simply to facilitate comparative analysis of alternative management strategies. For instance, one might consider limiting entry on the basis of low earning/effort ratio combined with low level of income (Group I); one might also focus on low earning/effort ratio regardless of the level of income (Group II); alternatively, one might emphasize high labor-low capital input combination associated with low income as an indicator of inefficiency (Group III); finally, high capital-low labor input combination regardless of a relatively higher level of income may be construed as an indicator of excess capacity (Group IV).

It should be noted that it is not the purpose of this study either to advocate or repudiate any particular management strategy

and its implicit goal. The intent here is simply to analyze the potential socio-economic impact of a change in the harvesting labor force in the Maine lobster fishery if such a change amounts to reducing inefficient inputs from given target groups.

For the purpose of this study such impact is analyzed primarily in terms of employment effects and income effects relative to the target group population and the local economy.

A. Employment Effects

Taking into consideration the employment related variables such as skills either from currently held part-time jobs or alternative jobs held in the past, level of education and age, a simplified profile of labor market participation potential of the target groups shows the following distribution:

TABLE 12

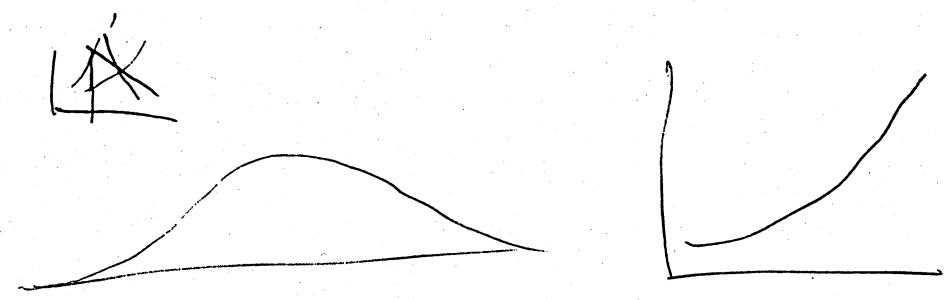
Labor Market Participation Potential
of Target Groups I-IV

Target Group	Total Number	Potentially Employable 1/	Possibly Trainable 2/	Potential hard-core unemployed 3/	Not in the labor force 4/
I	40 100.0%	14 35.0%	4 10.0%	8 20.0%	14 35.0%
II	48 100.0%	18 37.5%	4 8.3%	17 35.4%	9 18.7%
III	28 100.0%	11 39.3%	2 7.1%	10 35.7%	5 17.9%
IV	6 100.0%	4 66.7%	1 16.7%	1 16.7%	----

- 1/ Those having marketable skills
 - 2/ Those having no skill but less than 35 years of age
 - 3/ Those having no skill and in the age bracket 35-65
 - 4/ Students and those over 65 years
- Source: University of Maine Survey Data, 1970.

40
48
28
12

(12.8)



The category "potentially employable" includes those individuals who have marketable skills acquired from formal vocational training and/or alternative job experience. This information from survey data was supplemented by information on local labor market through the cooperation of the regional offices of the Maine Employment Security Commission.

If there was a match between the kinds of skills in demand in the local labor market and the skills possessed, an individual was considered eligible for the category "potentially employable."

The category "possibly trainable" includes those who on the basis of age and level of education would be likely to benefit from and capable of participating in a training program. Admittedly, this is nothing but a first approximation.

The category "potential hard-core unemployed" includes those fishermen who have no marketable skills other than lobstering and who fall into the critical age bracket by labor market criterion, 35-65. In all likelihood, these individuals, if excluded from lobstering, will find it extremely hard to make any vocational re-adjustment.

The last category, "not in the labor force" is self-explanatory. This includes those fishermen who are either students or over 65 years of age and are not likely to participate in the labor market as active job seekers, barring purely part-time or seasonal jobs.

It should be borne in mind that the above classification is only a preliminary step in identifying the differences in labor market participation potential of various sub-groups within each of the target groups. To be sure, potential employability, trainability and hard-core unemployment requires considerably more in-depth analysis than was possible

in the present study.

It is apparent from the table that a substantial proportion of the fishermen in each of the target groups is potentially employable (ranging from 35 percent to 67 percent). Of those who are classified under "potentially employable," some already have full-time jobs and others have marketable skills. However, Target Groups II and III are likely to have a more severe impact on the volume of hard-core unemployment. Paradoxically, the group that has a high effort/earning ratio (Target Group IV) also happens to be the one with a relatively larger proportion of potential employability. With the exception of this group, other groups include several fishermen not in the labor force, students, and those 65 years and over in age. The question of their employability is, therefore, irrelevant in the present context.

In analyzing the expected socio-economic impact of limited entry, the survey data on each of the fishermen in each of the target groups were examined in depth by communities. In this investigation, attention was focused on such socio-economic variables as age, family size, level of education, types of skill, alternative job experience, alternative source of income and so on. On the basis of information from survey data combined with information on local labor market, Table 13 is reconstructed to reflect the differences in labor market participation potential by communities.

TABLE 13

Labor Market Participation Potential of
Target Groups I-IV by Geographic Location

Target Group by Communities	Total Number	Potentially Employable 1/	Possibly Trainable 2/	Potential Hard-core Unemployed 3/	Not in the Labor Force 4/
I Phippsburg	15	7	2	3	3
I Corea	7	3	1	--	3
I Beals	18	4	1	5	8
	40	14	4	8	14
II Phippsburg	14	8	--	4	2
II Corea	3	1	1	--	1
II Beals	31	9	3	13	6
	48	18	4	17	9
III Phippsburg	9	5	--	3	1
III Corea	3	2	1	--	--
III Beals	16	4	1	7	4
	28	11	2	10	5
IV Phippsburg	--	--	--	--	--
IV Corea	2	1	1	--	--
IV Beals	4	3	--	1	--
	6	4	1	1	--

1/ Those having marketable skills

2/ Those having no skill but less than 35 years of age

3/ Those having no skill and in the age bracket 35-65

4/ Students and those over 65 years

Source: University of Maine Survey Data, 1970.

B. Income Effect and Expected Socio-Economic Impact

To perform the necessary analysis, the following procedure was adopted:

1. Assume that each of the target groups are considered as candidates for exclusion from lobstering
2. On this assumption, estimate private loss of income due to non-participation in lobster fishery. This estimate was derived from survey data on gross income reported by the fishermen. It was not feasible to derive net income figures.
3. Assume that 50 percent of the lost gross income would be additionally earned by the remaining fishermen. In the absence of historical data, it was impossible to use any precise proportion. It is plausible that if a fraction of the harvesting labor force is excluded, the remaining fishermen would be induced to capture more lobsters because of access to additional fishing grounds, availability of excess capacity and continuing consumer demand. The survey data did indicate some evidence of excess capacity in terms of number of traps owned and number of traps fished. Discrepancies in the ratios of number of days fished and the amount of investment in trap gear also indicate excess capacity either in terms of effort or investment. It was recognized that the remaining fishermen may not be willing or able to capture the entire amount of output attributable to the excluded fishermen, at least in the short run. The 50 percent figure is a guess and this is believed to be as good as any other guess. Furthermore, the purpose here is to illustrate what might happen if this assumption holds. Naturally, if in real life a different figure proves to be more realistic, the results will change.

4. Estimate the savings (or dis-saving) in effort measured by trap-days on the basis of (3) and convert this into monetary values. The reason for obtaining this result is this: if a fraction of the lobster catch attributable to the excluded fishermen is to be captured by the remaining fishermen, depending on their yield/effort ratio (gross income was used in the study as a proxy for yeild), certain saving (or dis-saving) may result. In any event, the survey produced data that could be used to derive this estimate. For this purpose, first it was calculated how many trap-days would be needed by the excluded fishermen in a given target group to produce the gross income attributed to this group. An average earnings/effort ratio for this group was used to calculate the number of trap-days required. Then an average earnings/effort ratio was computed for fishermen in the total sample excluding those in the given target group. This average ratio was applied to 50 percent of the total gross income of the group to come up with the number of trap-days that would be required to produce this income by the remaining fishermen. The difference between the two values for trap-days is stated as saving (or dis-saving) in effort. This quantity multiplied by the average earnings/effort ratio of the remaining fishermen produced a monetary measure of saving (or dis-saving) that can be expected under the stipulated conditions.
5. Estimate the sum of expected new incomes generated by those who are considered "potentially employable" on the basis of indicated market-able skills either from formal vocational training or from alternative job experience and on the basis of information on types of jobs.

available and skills needed in the local market. First the number of fishermen in each target group that fits this category was identified and typical wages for indicated jobs were applied to the number of employable fishermen to produce a sum of expected income.

6. Estimate the expected annual income of those that are classified as "possibly trainable" on the basis of age and level of education. Assume that training facilities and programs are made available and then individuals are willing to participate. Verbal communication from people involved with Manpower Development and Training Act (MDTA) programs provided some information as to typical wages MDTA trainees can expect post-training. These figures were used to arrive at expected incomes that the "possibly trainable" fishermen in each target group can expect if they receive training comparable to those under MDTA programs. Admittedly, these are crude estimates.
7. Estimate the training cost of those classified under "possibly trainable!" Here again information from MDTA program officials was utilized to arrive at the cost of training of these individuals.
8. Estimate the potential income-maintenance burden on society imposed by the loss of lobstering income of those who are classified under "potentially hard-core unemployed" and under "not in the labor force." Use 50 percent of current gross income from lobstering for estimating purposes. The rationale for using this percentage is based on the consideration that the net income from lobstering is substantially lower than reported gross income, although exact figures for net income were not feasible to collect. During the course of the interviews, several fishermen indicated that although they could not provide

information on net income, roughly 50 percent of their gross income could be considered net, after allowing for business expenses. One could quibble over this percentage but in the absence of any precise data on gross versus net income, the assumed percentage is considered reasonable for illustrative purposes.

The reason why the individuals in these categories--"potential hard-core unemployed" and "not in the labor force"--and their loss of income from lobstering are used as the basis for measuring the income maintenance burden on society is to indicate the upper limit of social burden. This yields an order of magnitude of income loss and corresponding welfare loss for^a group of people who are technically outside the labor force in the sense that they are not actively seeking jobs because of age, lack of marketable skills and other commitments. At least in the short-run, the process of adjustment will be quite severe for a bulk of this group. Conceivably, some low level, unskilled jobs would be available which would moderate the impact. However, considering the high level of current unemployment and the generally depressed conditions of the local economies under consideration, it appeared reasonable to assume that alternative sources of income would be unavailable, at least in the short-run, thereby imposing a burden on society. How much of this lost income could be covered by welfare benefits and what would be the fiscal impact on the local economies could not be ascertained for a variety of reasons. Sufficient information on fiscal capability of the local governments, the various eligibility requirements for welfare recipients and the number of people who might go on welfare and other pertinent information were

not readily available. The only purpose the derived estimates serve is to provide an indicator of the upper limit of the magnitude of social burden that limited entry might impose.

9. The estimated value of investment in boat and gear by the fishermen in each of the target groups is included in the profile of socio-economic impact of limited entry for the reason that these values have definite implications for compensation. In any management scheme that may result in the elimination of a fraction of fishermen from lobstering and idling of a certain amount of physical capital, the question of compensation has to be raised. This is part of the process of adjustment. Assuming zero salvage value of such capital equipment, the stated figures provide the upper limit of the compensation burden imposed on society. It is reasonable to think actual compensation, if accepted as a part of the scheme, will be less than the stated figures because some positive salvage value. For illustrative purposes, without making such allowance, the quoted figures do serve as indicators of upper limits of the cost of compensation that may be entailed.

Using the above procedure, the following tabulations were made to present a comparative picture of the socio-economic implications of limiting entry of different groups by using alternative criteria.

TABLE 14

Profile of Socio-Economic Impact by Target Groups

Impact Variables	Target Groups			
	I	II	III	IV
1. Loss of income from lobstering (\$)	-82,450	-250,223	-161,583	-61,000
2. Gain of income from lobstering (\$)	+41,225	+125,116	+ 80,791	+30,500
3. Monetary value of saving in effort (\$)	+18,574	+168,670	+ 31,346	-11,083
4. Gain of income from alternative jobs (marketable skills)(\$)	+19,000	+ 41,500	+ 38,000	+21,000
5. Gain of income from alternative jobs (post-training)(\$)	+24,000	+ 24,000	+ 12,000	+12,000
6. Training costs (\$)	-13,800	- 13,800	- 6,400	- 6,400
7. Income Maintenance Burden on Society (\$)	-26,775	- 64,225	- 54,200	- 3,500
8. Estimated value of investment in boat and gear (\$)	-97,043	-332,566	-123,485	-74,465
9. Number of Fishermen	40	48	28	6

Source: University of Maine Survey Data, 1970; local MDTA program officials

Group II is likely to cause the largest decline in income from lobstering which will be partially offset by additional income from lobstering by the remaining fishermen, income from alternative jobs for the displaced fishermen and the savings in effort measured by the fewer number of trap-days required to capture at least 50 percent of the gross income lost. In absolute terms, this group may present the severest income maintenance burden on

society. By comparison, Group I is likely to impose a relatively smaller burden on society. On a per capita basis, Group III will impose the severest burden on society.

The proportion of the "potentially employable" and "possibly trainable" among Groups I-III are quite comparable. The proportion of the same categories for Group IV is considerably higher. This accounts for the relatively small social burden indicated for this group. However, it should be noted that this underestimates the total real burden on society in that there will be a dis-saving in effort and potential negative difference between their current income from lobstering and their expected income from alternative jobs.

It would have been desirable to compute a ratio of total gains and losses. However, with the data in hand, it does not appear to be feasible and meaningful. First, the quantities calculated are not additive. Second, costs and benefits have different time dimensions. For instance, training costs are once-over cost items whereas the expected income is a flow over time. Finally, the figures for income maintenance burden on society do not take into consideration the loss of income from lobstering of those who are classified as "potentially employable" but are already employed. Furthermore, the discrepancy between current income from lobstering and expected income from alternative jobs for those employable but currently full-time fishermen is also disregarded.

Despite these limitations, the results do give certain indicator values that should be considered and comparatively analyzed relative to alternative management strategies and implicit goals. Admittedly, these values involve many simplifying and rather arbitrary assumptions, although hard data was utilized when available. The value of this type of approach is primarily methodological, which is only to be expected in a pilot study.

Several qualifications need to be attached to the foregoing analysis before any generalization is made. First, some fishermen who are considered as candidates for a given target group may continue to lobster because of non-economic reasons. Second, expected new incomes from alternative jobs for the displaced fishermen may not materialize because of lack of motivation and reluctance to move geographically and/or occupationally. Third, there is no assurance that the additional new income earned by the remaining lobstermen will exactly equal the lost income due to limited entry. There is, however, a strong probability that if they were to capture the same number of lobsters as attributable to the displaced fishermen, they could do so more efficiently because of excess capacity and potential economies of scale. Fourth, there may be a significant gap between the number of those considered trainable and those who will take advantage of training if made available. Fifth, a fraction of those trained may still remain unemployed due to labor market conditions. Sixth, the income maintenance burden may not be as severe as indicated because some of the potentially hard-core unemployed may be absorbed in unskilled jobs or in the lobster industry as "helpers." Conceivably, jobs may be redesigned to facilitate the entry of these men into the labor market. Finally, some of those who are not in the labor force, e.g., students, will in course of time participate in the labor market and reduce the stated social burden.

It is important that in this kind of analysis one takes cognizance of the time element relative to the process of adjustment. The short-run impact may appear to be quite severe because of the imperfections in the labor market. For instance, men who are unemployed now may not have marketable skills; men who have marketable skills may not have information about available jobs or

may have very restricted mobility; job structure may be such that it precludes entry of unskilled workers; those who are trainable may not have adequate training facilities or programs. Given time, however, some of these market imperfections may be reduced, partially through deliberate planning and partially through autonomous changes in the labor market itself. For instance, the quality of job information and job counselling can be improved; training programs may be initiated; jobs may be restructured; local economic development may generate new demands for labor; the lobster fishery itself, if efficiently managed by fewer fishermen may need additional helpers.

It is a reasonable expectation that if a management strategy results in an improved return to both labor and capital and if deliberate efforts are made to aid the process of adjustment, net social gains are likely to materialize in the long-run.

3 In conclusion, it may be pointed out that although the present study did not consider, nor was intended to consider, any specific management scheme with respect to its socio-economic impact, it did generate data pertinent to such an investigation. Further plans for additional work includes a conference of representatives from the lobster fishery, Federal and State agencies and the academic community to review the findings of this study and to consider alternative management schemes. Hopefully as a follow-up to this conference, additional studies will yield more definitive conclusions about the socio-economic repercussions associated with alternative management schemes and thereby provide useful guidance for policy-making.



