The Regional Impact of Resource Management

By Frederick W. Bell and
Richard F. Fullenbaum

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U.S. NATIONAL MARINE FISHERIES SERVICE
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Introduction

As resource management and environmental concerns become relatively more important in the local and regional decision-making process, increasing attention will focus upon the economic costs which these policies encompass. More precisely, conservation policies will be assessed in terms of potential adverse employment effects. This is particularly crucial because decisions of this nature will often be made for rural economies which are afflicted with initially large pockets of chronic unemployment and poverty.

The purpose of this paper is to gain insight into the employment costs associated with resource management policies. We will develop a model of natural resource exploitation and apply that model to a rural region. The fundamental question, the answer upon which the severity of employment effects rests, is this: Will a strategy of limited access eliminate individuals from a resource related

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*The authors are Director, Economic Research Laboratory, National Marine Fisheries Service, U.S. Department of Commerce, and Economist, Office of Management and Budget. The comments in this paper do not necessarily reflect the official position of either the Department of Commerce or the Executive Office of the President.

activity who have few, if any, opportunities elsewhere in the local economy? If the answer is no, employment effects will be minimal; if the answer is yes, then regional unemployment impacts may be profound. We shall consider as our case example a replenishable resource, the American lobster (Homarus americanus), which is important to the economy of parts of rural New England such as Maine. Local data on the socioeconomic characteristics of a representative portion of the Maine harvesting labor force will be used to determine the type of regional adjustment which is made in response to an optimally designed management plan. Section one presents some formal models which focus upon the economic rationale for resource management. Section two presents the necessary modifications which must be made in order to determine the type of individuals who are affected by a given resource strategy. Section three discusses the results of the Maine survey and implications in terms of potential employment effects. Finally, section four presents some tentative conclusions.

I. Economic Rationale for Resource Management

A. Specification of the General Resource Use Model

In this section, we shall specify a long-run model of the exploitation of a common property living marine resource under conditions of free entry. The model may be set forth as follows:

$$\dot{X} = f(X,Kx) \tag{1}$$

$$\begin{aligned} Kx &= Kg(X,K) \\ x &= g(X,K) \end{aligned} \tag{2}$$

$$C = K\tilde{\pi} \tag{3}$$

$$\pi = pKx - C = pKg(X,K) - K\tilde{\pi} \tag{4}$$

$$\dot{K} = \begin{cases} \delta^1\pi, & \pi > 0 \\ \delta^2\pi, & \pi < 0 \end{cases} \tag{5}$$

In the above system, X is the biomass, K is equal to the number of homogeneous operating units or vessels, x is the catch rate per vessel, C is total industry cost, $\tilde{\pi}$ is equal to opportunity cost per vessel, π is industry profit, p is price, and δ^1, δ^2 represent the rates of entry and exit of inputs respectively. Equation (1) represents the biological growth function in which the natural yield or net change in the biomass is dependent upon the size of the biomass, X, and the harvest rate, Kx. X reflects the influence of environmental factors such as available space or food which constrains the growth in the biomass as the latter increases. The harvest rate, Kx, summarizes all growth factors induced by fishing activity. Equation (2) presents the industry and firm production function for which it is normally assumed that $\frac{\partial g}{\partial X} \equiv g_1 > 0$, and $\frac{\partial g}{\partial K} \equiv g_2 < 0$.[1] Equations (3) and (4) are the industry total cost and total profit functions respectively. The equilibrium condition for the industry ($\pi = o$) may be formulated as,

$$p = \frac{\tilde{\pi}}{g(X,K)} \qquad (6)$$

There are two important properties of the system outlined in (1) - (5). First, the optimum size of the firm is given and may be indexed by $\tilde{\pi}$. Thus, the firm is pre-defined as a bundle of inputs.[2] Secondly, the long run catch rate per vessel per unit of time is beyond the individual firm's control.[3] It is, in effect, determined by stock or technological externalities.

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[1] In some developing fisheries, it is possible that $g_2 > o$. For example, in the Japanese Pacific tuna fishery, intercommunication between vessels may increase the catch rate as more vessels enter the fishing grounds.

[2] In other words, because we are dealing with a long-run theory of the industry, we are assuming that variations in output result from the entry or exit of optimum sized homogeneous vessels.

[3] We have implicitly assumed that such short-run changes as longer fishing seasons, etc., are all subsumed in a long-run context. Longer fishing seasons, for example do not change catch rates per unit of time fished nor do they change costs per unit of time fished. They do change the effective level of K.

B. Economic Theory of Fishery Management

Some exact specifications of the system outlined in the preceding section will serve to illustrate the general misallocation which occurs under common property conditions and highlight some alternative management strategies. Suppose that the biological growth function and the industry production function are given respectively as $\dot{X} = aX - bX^2 - Kx$ and $Kx = rKX$, where r is a technological parameter and a and b are biological constants. Assume further that price is parametric and equal to $\overline{p}$. Abstracting from discount rate considerations by setting $\dot{X} = o$, and substituting the production function into the biological growth function, we may derive an expression for output, Kx, solely in terms of the number of vessels:

$$Kx = \frac{ar}{b} K - \frac{r^2}{b} K^2 \qquad (7)$$

Long-run industry marginal cost (MC) and long-run industry average cost (AC) may then be defined as,

$$AC \equiv \frac{\hat{\Pi}}{x} = \frac{\hat{\Pi} b}{ar - r^2 K} \qquad (8)$$

$$MC \equiv \frac{\hat{\Pi}}{\frac{\partial Kx}{\partial K}} = \frac{\hat{\Pi} b}{ar - 2r^2 K} \qquad (9)$$

We may thus map average cost and marginal cost against output by solving (7) for output and (8) and (9) for AC and MC respectively. This mapping is depicted in figure 1. For any given price, $\bar{p}$, it is evident that free-access leads to economic overexploitation, i.e., exploitation carried to the point of average cost, but not marginal cost, pricing. Thus, given the industry profit function $\Pi = \frac{\bar{p}ar}{b}K - \frac{\bar{p}r^2K^2}{b} - K\hat{\Pi}$, free entry will yield a solution of

$$K° = \frac{a}{r} - \frac{\hat{\Pi}b}{\bar{p}r^2} \qquad (10)$$

However, the socially optimum level of capital is:

$$K^* = \frac{a}{2r} - \frac{\hat{\Pi}b}{2\bar{p}r^2} \qquad (11)$$

If the management authority wishes to enforce a marginal cost pricing scheme within a purely competitive, free-access context, then a tax per vessel, T_k, may be imposed so as to attain K*:

$$T_k = \bar{p}\,\frac{ar}{2b} - \frac{\hat{\Pi}}{2} \qquad (12)$$

On the other hand, suppose that the management authority's primary objective is the prevention of overfishing -- and not economic efficiency.[4]

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[4] Overfishing is defined as the level of fishing pressure, measured by K, beyond that needed to harvest the maximum equilibrium yield, i.e., the maximum of equation (7).

The level of K consistent with this policy is equal to $\frac{a}{2r}$. Either a modified tax or stock certificate plan--in which each firm or fisherman is guaranteed the right to catch a given percentage of maximum yield--may be utilized to implement these policy objectives.

These resource management plans are merely illustrative of an entire spectrum of possibilities. Which programs are adopted, of course, may depend upon the weights attached to economic efficiency and second-best criteria.

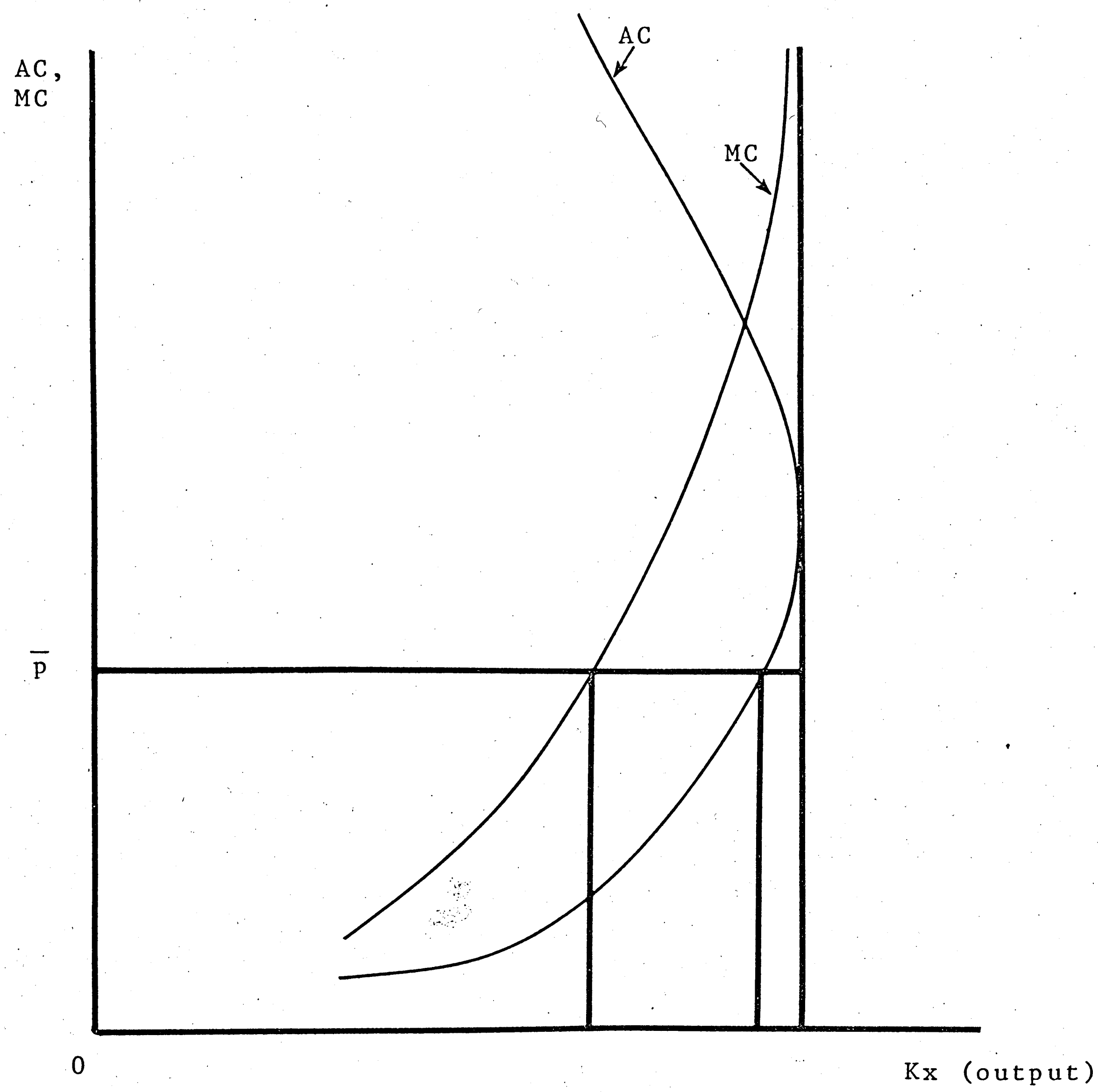

Figure 1

II. Some Regional Adaptations

Up to this point, emphasis has been placed upon the impact of technological externalities in a competitive setting, and the economic rationale for resource management. However, once attention is shifted to the regional adjustment mechanism which a particular management policy entails, a series of more subtle and more difficult questions must be answered. The questions relate to the relaxation of the "homogeneity" postulate and the explicit recognition of pecuniary externalities. That is, in any given community there exists a distribution of opportunity costs in the labor force employed in any given industry. Similarly, there also exists a distribution of skills or productivities. These two sets of characteristics jointly determine the social costs of production, revenues, and--as a consequence--rents that are earned in the regional fishery.[5] The approach which must be adopted is

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[5] The presence of pecuniary externalities modifies the condition for equilibrium in the fishery. Assume that the marginal cost of an additional vessel varies directly with K, so that,

$$\frac{\partial Kx}{\partial K} = K \qquad (6.1)$$

In this framework, costs per vessel, $\tilde{\pi}$, are equal to

$$\frac{\int_0^K K dK}{K} = \frac{K}{2} \qquad (6.2)$$

(Continued)

to rank individuals by opportunity cost--presumably an index of mobility--and to compare this ranking with an ordering of rents. This is essentially an empirical exercise. If those who earn the highest inframarginal rents also have the highest opportunity cost, then limited entry will tend to increase unemployment. If, on the other hand, those who earn the highest rents have the lowest opportunity cost, unemployment effects would be minimal. This will be the focus of our sample survey.

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5 (Continued) The equilibrium condition under a free access situation can now be restated as $p = \frac{K}{x}$, whereas marginal cost is given as $\frac{K}{\frac{\partial Kx}{\partial K}}$. Thus, even with free access, there will be inframarginal rents.

III. The Maine American Lobster Fishery: A Case Study

The Maine lobster fishery represents a good case study for a number of reasons. First, the American lobster is considered a high quality seafood item and is a popularly consumed species. Secondly, because of intensive fishing pressure, several attempts have been made to manage the Maine lobster resource.[6] Thirdly, the Maine economy is typically rural with few urban centers, and thus represents the type of economy in which displacement of labor could easily depress both the rural subeconomy and increase unemployment rates in the urban centers. Finally, the American lobster fishery contributes proportionately more to the Maine economy than does fishing activity in general to other state economies.[7]

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[6] U.S. landings of inshore trap-caught American lobsters--of which the Maine lobster accounts for 80 percent--increased from approximately 23 million pounds in 1950 to a peak of over 29 million pounds by 1957. Since 1957, landings have fallen off reaching a low of but 22 million pounds in 1967. Despite the poor performance of production over the 1950-67 period, the number of lobster traps fished per year (i.e., a proxy for fishing effort) has increased secularly from approximately 579,000 to over 947,000 in 1966. Because of these past events, several bills have been presented in the Maine Legislature to apply some sort of stringent licensing scheme intended to limit entry.

[7] It has been estimated that for 1970 the lobster fishery--inclusive of processing, exports to other states, and tourists attracted to the State as a result of the fishery--contributed approximately $54.3 million to the personal income of the residents of Maine. See Erwin S. Penn. Economic Impact of Northern Lobster Fishery in Maine. Economic Research Laboratory, National Marine Fisheries Service, U.S. Department of Commerce, unpublished manuscript.

Our discussion of the Maine survey may be subdivided into three logical components. Subsection A discusses the characteristics of the sample and types of questions which were asked. Subsection B presents the techniques and assumptions that were used to determine the average social costs of production, and subsection C presents the final results.

A. Data Utilized for the Maine Sample

Our sample data are based upon a survey taken by a team of economists at the University of Maine in the summer of 1970. Three small communities in Maine--Phippsburg, Corea, and Beals--were sampled. These three areas account for 277 out of the 6,316 fishermen licensed in Maine in 1970. Approximately 137, or roughly half, of the fishermen were interviewed, so that the sample represented 2.2 percent of the fishermen population. The sample appears to be fairly representative in terms of age composition and other demographic features. In addition, it reflects the appropriate proportion of full-time to part-time fishermen found in the population of 6,316 fishermen.[8]

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[8] There were 32 part-time respondents out of a total of 137. However, the criterion established here for part-time is whether less than 50 percent of gross income was earned from lobstering. However, the licensing agency in Maine classifies lobstermen on a part-time basis if their licenses were obtained after April 1. The two criteria are not necessarily correlated.

The questions asked were designed to obtain the following type of information:

Categories	Types of Information
Demographic	Age Family size and composition Mobility Marital status
Socio-economic	Income Employment history Education and training Monetary return Parental occupation Housing
Operational	Gear types Investment in boat and gear Operating expenses Maintenance and repair expenditures Size of operations Seasonal patterns Rate of capacity utilization
Behavioral-Attitudinal	Reasons for lobstering Job interests Attitudes toward leaving the lobster industry Job seeking Attitudes toward training, views on excess capacity

Of particular interest and importance were the questions asked in the "Behavioral-Attitudinal" category. This set of questions was critical because these could possibly give some clues as to labor mobility and opportunity cost. A typical series of questions would include:

(1) Have you ever considered leaving the lobster industry?

(2) If yes, what would you do?

(3) If the lobster supply failed what would you do to support yourself?

(4) Any formal vocational training?

(a) If yes, what kind of training?

(b) If no, what training would you like to receive?

Depending upon the respondent's answers, the following set of subcategories is typical of the range of alternative opportunities and/or training interests:

(1) Professional

(2) Metal working

(3) Electrical

(4) Carpentry

(5) Clerical

(6) Labor

(7) Social security

(8) Welfare

(9) Don't know

(10) Other fishing

This gives us some idea as to the range of employment opportunities and thus the degree of mobility.

B. Techniques

Given all of the information obtained in the survey, the sample was divided into four groups based upon the degree of mobility out of the fishery. Group one includes the potentially employable individuals who possess skills which are marketable in the local labor market.[9] This group also includes all part-time fishermen in the sample. Group two consists of the possibly trainable fishermen. The criterion established for this group is two-fold: 1) individuals have to be less than 35 years old and 2) they must have enough education so that they can participate and benefit from training programs. Despite possible subjectivity involved in the selection criteria, group two can serve as an approximation of the intermediate individuals who are neither completely mobile nor completely immobile. Group three consists of potential hard-core unemployed fishermen. These are the individuals who are between 35 and 65 years old and who have no marketable skills. Finally, group four contains those individuals who are not in the labor force--students, or fishermen over 65.

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[9] The Maine Employment Security Commission provided supplemental information which was useful in ascertaining which skills were marketable in the areas covered by the survey.

The procedure then used was to derive some estimates of opportunity cost for the sample fishermen. For groups three and four, opportunity costs were assumed to be equal to zero. For groups one and two, estimates of regional wage rates for the particular skills indicated were obtained via the Maine Employment Security Commission. Ignoring capital costs,[10] we can derive total social cost by adding our estimates of opportunity cost to variable expenses, calculated from answers given in the survey. Since gross income was also obtained from the survey, we can determine average social cost per unit of output (AC) for each fisherman in the following manner:

$$AC = \left(\frac{\text{Opportunity Cost + Variable Expenses}}{\text{Gross Income}}\right) X \text{ (Price)}$$

The price used was .8, the average annual price per pound of Maine lobsters in 1970.

C. Results

Figure 2 plots average social cost against the ranking of fishermen in the sample on this basis. Appendix

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[10] Capital is assumed to be completely immobile out of the fishery. This is probably not a bad assumption for the Maine lobster fishery.

A presents the same ranking, but also furnishes information regarding the group number (i.e., mobility status), years of education, age, and days lobstering for each individual in the sample.

To determine which of the groups comprise high and low average social cost, we have derived the following percentage breakdowns. Each percentage given relates the percentage of a given group in a particular quartile. Thus, we have:

Average Cost Rankings

Group 1	Group 2	Group 3	Group 4
lowest 25 percent (34 members):			
2/54= 3.7%	6/16=37.5%	2/29=41.4%	14/36=38.9%
next lowest 25 percent (33 members):			
12/54=22.2%	3/16=18.8%	9/29=31.0%	9/36=25%
next lowest 25 percent (33 members):			
14/54=25.9%	2/16=12.5%	6/29=20.7%	11/36=30.6%
highest 25 percent (35 members):			
26/54=48.1%	5/16=31.25%	2/29=6.9%	2/36=5.6%
Total:			
100.0%	100.0%	100.0%	100.0%

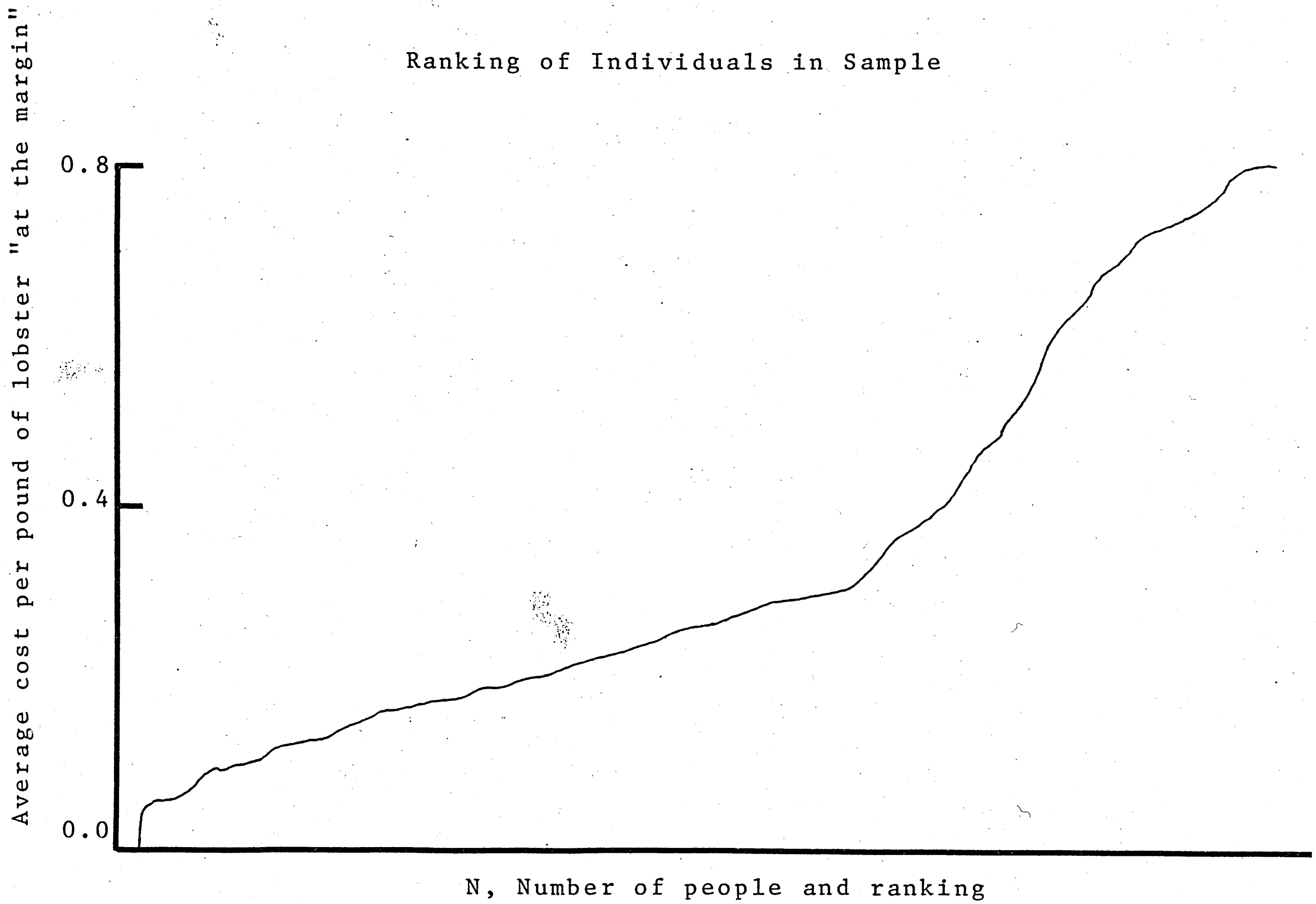
Ranking of Individuals in Sample
Average cost per pound of lobster "at the margin"
0.8
0.4
0.0
N, Number of people and ranking

Figure 2

Thus, 48.1 percent of group one was in the highest quartile in terms of average cost. Alternatively, group one members comprised 74.3 percent of the highest cost category.

It is clear that a disproportionately higher number of fishermen in group one and group two would leave the fishery in response to a limited entry scheme such as a taxing measure, auctioning device, etc. What this means, in effect, is that those who leave the fishery have the highest opportunity costs.

IV. Conclusion

The results which we have obtained in the Maine study, if representative of the type of adjustment which will occur in other areas, indicate that those most likely to remain in the fishery are those who are least likely to find jobs in other industries. Thus, the spectre of significant unemployment effects may be at least partially dispelled. It is important to add, however, that fishing is still a small sector relative to the total output of the regional economy. Consequently, it is easier for the rest of the economy to absorb displaced labor. This may not be the case for a resource activity which plays a prominent role in the regional economy.

We have not integrated our analysis of regional adjustment patterns into the technological externalities framework developed earlier in the paper.[11] Nonetheless, the numerical magnitude involved in any limited entry schemes--i.e., how many will leave--is not independent of the compositional question answered in this paper--i.e., who will leave. Although the focus of this study was not related to an analysis of alternative resource

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[11] See Appendix B for an in-depth analysis of how this problem may be handled.

management strategies, one point is abundantly clear. The management authority should not attempt to directly determine the socioeconomic characteristics of those who leave the fishery.

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Appendix A

Ranking (lowest average cost to highest average cost per unit of output) of sample lobstermen

Rank	Average cost	Age	Education	Days lobstering	Group number*
1	.0000	52	12	62	1
2	.0564	21	15	70	4
3	.0593	65	5	48	4
4	.0612	56	8	120	3
5	.0640	65	12	120	4
6	.0640	71	9	60	4
7	.0779	54	9	80	3
8	.0846	44	8	72	2
9	.0906	59	12	136	3
10	.0928	61	9	81	3
11	.0932	32	12	140	2
12	.0960	58	7	80	3
13	.1012	25	8	81	2
14	.1032	67	7	60	4
15	.1032	49	12	123	3
16	.1201	48	9	160	3
17	.1233	80	8	96	4
18	.1252	33	7	54	2
19	.1252	43	12	36	1
20	.1280	45	8	112	3
21	.1280	56	8	80	3
22	.1400	38	12	160	3
23	.1480	24	10	108	2
24	.1512	28	8	84	2
25	.1536	72	5	96	4
26	.1536	16	10	36	4
27	.1555	66	20+	48	4
28	.1570	54	9	160	3
29	.1600	12	6	20	4
30	.1632	65	9	136	4
31	.1645	35	7	80	3
32	.1664	70	9	48	4
33	.1680	67	10	72	4
34	.1680	18	13	16	4
35	.1685	47	12	56	1
36	.1713	37	12	120	3
37	.1744	47	8	160	3
38	.1752	56	9	84	3
39	.1756	73	9	128	4
40	.1789	16	9	56	4

Appendix A

Ranking (lowest average cost to highest average cost per unit of output) of sample lobstermen

Rank	Average cost	Age	Education	Days lobstering	Group number*
41	.1789	14	10	56	4
42	.1840	34	12	92	2
43	.1866	68	7	50	4
44	.1872	45	8	72	1
45	.1920	39	7	160	3
46	.1920	38	10	120	3
47	.1920	29	12	160	2
48	.1968	40	10	32	1
49	.2070	36	12	160	3
50	.2073	28	16	108	1
51	.2142	34	7	95	2
52	.2153	17	11	72	4
53	.2164	49	8	110	1
54	.2182	27	13	85	1
55	.2193	59	8	160	3
56	.2262	31	9	66	1
57	.2266	18	11	110	4
58	.2304	51	12	36	1
59	.2352	60	12	126	3
60	.2356	65	8	104	4
61	.2420	15	9	36	4
62	.2429	39	8	156	3
63	.2476	27	11	96	1
64	.2560	24	12	80	1
65	.2580	18	12	80	1
66	.2600	43	12	130	1
67	.2664	22	15	70	4
68	.2666	16	11	50	4
69	.2704	69	7	84	4
70	.2742	35	8	160	1
71	.2754	48	8	168	3
72	.2860	37	12	110	1
73	.2880	19	13	56	4
74	.2892	71	8	140	4
75	.2940	37	12	105	1
76	.2960	27	8	108	2
77	.3009	36	7	62	3
78	.3016	18	11	44	1
79	.3064	61	8	144	3
80	.3072	14	9	96	4

Appendix A

Ranking (lowest average cost to highest average cost per unit of output) of sample lobstermen

Rank	Average cost	Age	Education	Days lobstering	Group number*
81	.3072	47	12	96	1
82	.3072	39	14	96	1
83	.3073	58	8	70	4
84	.3080	22	14	100	1
85	.3116	31	12	84	2
86	.3161	54	11	160	1
87	.3240	60	8	156	3
88	.3300	69	18	110	4
89	.3400	89	9	72	4
90	.3412	39	7	160	3
91	.3702	20	12	72	1
92	.3748	17	11	58	4
93	.3764	28	12	132	1
94	.3840	72	9	120	4
95	.3974	59	9	108	3
96	.4000	67	8	100	4
97	.4000	27	12	48	1
98	.4308	52	9	120	1
99	.4388	48	8	160	1
100	.4515	53	12	108	1
101	.4800	20	12	160	2
102	.4800	58	7	168	3
103	.4800	17	11	60	4
104	.5014	60	6	140	3
105	.5216	27	12	146	1
106	.5260	30	12	136	1
107	.5383	50	9	160	1
108	.5984	36	12	160	1
109	.6026	30	12	102	1
110	.6041	26	12	128	2
111	.6149	26	12	100	1
112	.6400	19	12	48	2
113	.6424	59	9	102	1
114	.6576	20	12	38	1
115	.6800	46	12	120	1
116	.6808	54	12	144	1
117	.6836	61	8	93	1
118	.7000	40	12	35	1
119	.7200	44	12	90	1
120	.7200	26	13	90	1

Appendix A

Ranking (lowest average cost to highest average cost per unit of output) of sample lobstermen

Rank	Average cost	Age	Education	Days lobstering	Group number*
121	.7200	26	12	160	2
122	.7271	55	8	90	1
123	.7288	52	9	140	1
124	.7313	28	14	32	1
125	.7313	66	8	32	1
126	.7422	17	12	72	2
127	.7441	47	12	144	1
128	.7656	63	16	160	1
129	.7666	44	7	45	4
130	.8000	30	12	102	1
131	.8000	52	10	100	1
132	.8000	48	8	144	1
133	.8000	41	15	140	1
134	.8000	23	12	96	1
135	.8000	49	10	152	1

*
Group 1 - Potentially employable
Group 2 - Possibly trainable
Group 3 - Potential hard-core unemployed
Group 4 - Not in labor force

Appendix B

A Suggested Integration of Technological and Pecuniary Externalities

The average social cost curve derived in figure 1 of the text embodies only pecuniary externalities. Since it is a cross section only, technological externalities are not included. The technological externality effectively shifts the average social cost function upward as aggregate effort (measured by the total number of traps) expands. We can easily map the curve in figure 1 onto output, in order to obtain the normal average cost curve as a function of output. Call this the AC^1 curve. If we know how this curve shifts downward (upward) for a small decline (expansion) of aggregate effort, we can derive a family of AC^1 schedules and plot points on various AC^1 schedules to obtain the long-run average cost schedule for the fishery. Fortunately, the technological externality has been measured by Bell[12]. For the entire New England inshore lobster fishery, output per trap was regressed against the number of traps and seawater temperature (an environmental variable) with the following results:

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[12] Bell, Frederick W. "Technological Externalities and Common-Property Resources: An Empirical Study of the U.S. Northern Lobster Fishery," Journal of Political Economy, 80 (January/February 1972), 148-158.

$$x = -48.3992 - \underset{(-3.37)}{.000024T} + \underset{(3.58)}{2.13\ (^\circ F)} \qquad (B.1)$$

where x is output per trap, T is the number of traps, and °F is the mean annual seawater temperature, Boothbay Harbor, Maine.

In order to derive the long-run average cost curve, the following steps must be followed:

(1) Given an initial set consisting of the AC curve (figure 1) and the AC^1 curve, calculate the percentage change in traps caused by a one percent reduction in the number of fishermen in the sample. The number of traps that each fisherman utilized was one of the types of information collected under the "operational" set of questions asked of the individuals in the sample. In addition, the first one percent reduction starts with those who have the highest cost per unit of output, then the next highest, and so on.

(2) From equation (B.1), calculate the percentage change in output per trap as a result of the calculated percentage change in traps. Apply that percentage change (in output per trap) to the remaining fishermen in the sample.

(3) Derive another set of AC, AC^1 curves. Everyone remaining in the sample should now be more

"productive," and thus the AC and AC^1 curves should shift downward. Connect the highest point (i.e., highest average cost per unit of output) on the original AC^1 curve consistent with the original sample size with the highest point on the new AC^1 curve which is consistent with the slightly reduced sample size. These two points represent a portion of the long-run average cost curve. After another AC^1 curve is derived, its highest point is connected to the highest point on the previous AC^1 curve, and so on.

(4) Repeat steps (1) to (3).

Steps (1) - (4) can easily be implemented via an iterative computer program which could also plot the long-run average cost curve.

Once the long-run average cost curve is obtained, the long-run marginal cost curve must be derived. In this context, the ratio of marginal cost to average cost is simply equal to $\frac{\frac{\partial Tx}{\partial T}}{x}$. This ratio can be computed from equation (B.1). Then, for each point on the long-run average cost schedule we can easily derive a corresponding point on the long-run marginal cost schedule by multiplying the former by the ratio of MC to AC.

Once all of this is completed, the regional impact of, say, a management policy designed to implement marginal cost pricing can be measured. That is, the real increase in regional welfare (output), the reduction in output in the fishery, the number of fishermen displaced, and the socioeconomic characteristics of the fishermen displaced--all of these factors can be simultaneously determined by our "simulation" of the market.