

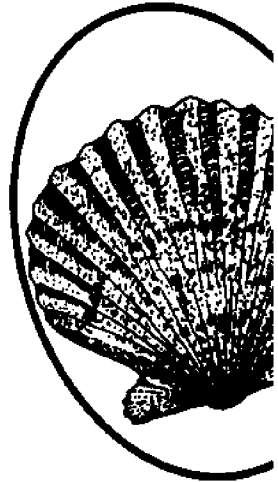
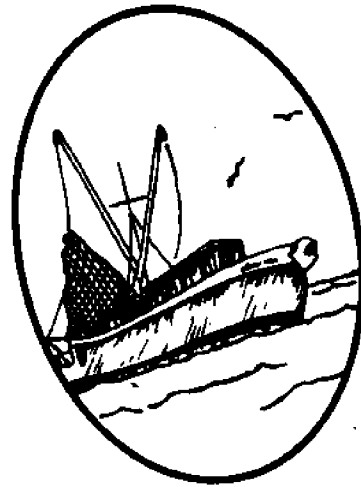
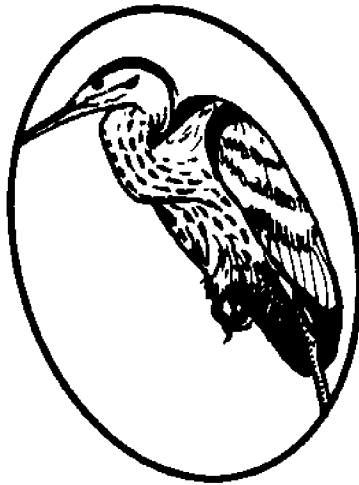
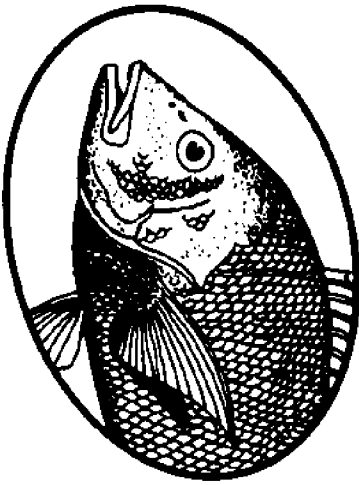
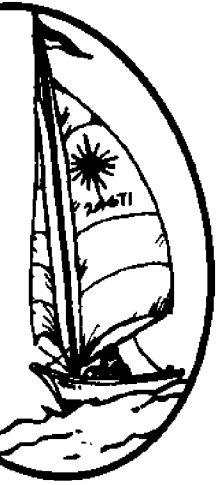
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Estimated Socio-Economic Impacts In North Carolina Of a Shortened Menhaden Season

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ESTIMATED SOCIO-ECONOMIC IMPACTS IN
NORTH CAROLINA OF A SHORTENED MENHADEN SEASON

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SUMMARY

A shortened season on the North Carolina menhaden industry has the potential to permanently reduce industry fish-meal revenues by 8.4 percent and wages accruing to the harvesting sector by 8.4 percent. Within the five years necessary for the menhaden resource to reach a new equilibrium size as a result of the shortened season, industry fish-meal revenues and harvest sector wages are projected to decline by as much as 20.2 percent in the first year and eventually to level off at the 8.4 percent level cited above.

Reduced catches and revenues of these magnitudes within the first five years of the proposed shortened season may force North Carolina menhaden firms out of business, and may lead to at least temporary unemployment among harvesting and processing workers. At issue is the industry's ability and willingness to withstand large short-term losses in order to operate at a somewhat reduced level in the long run. Another important issue is the ability of the industry's labor force, with a generally low level of education and training, to find alternative employment.

Local and regional economies will experience declines in economic activity as a result of reduced menhaden industry revenues and payrolls. Unemployment may also increase in local and regional economies in related industries.

Using current fish-meal and fish-oil prices, and current pay scales to harvesting and processing workers, the monetary effects on North Carolina menhaden firms and regional economy¹ are projected to be:

Maximum annual decrease in fish meal revenues -	\$2,015,250
Permanent annual decrease in fish meal revenues -	\$837,750
Maximum annual decrease in fish oil revenues -	\$217,579
Permanent annual decrease in fish oil revenues -	\$101,941
Maximum annual decrease in industry payroll -	\$500,351
Permanent annual decrease in industry payroll -	\$208,636
Maximum annual decrease in regional economic activity -	\$3,398,518
Permanent annual decrease in regional economic activity -	\$1,412,782
Maximum annual decrease in related employment -	360 man years
Permanent annual decrease in related employment -	149 man years

These monetary estimates assume that North Carolina menhaden firms remain in operation during and after the five years it would take to adjust completely to a shortened season. However, if all the firms in the industry cease operation, the impacts may be up to five times larger than indicated in the maximum annual amounts noted above.

Introduction

During September of 1982 the North Carolina Marine Fisheries Commission discussed a recommendation to shorten the menhaden (*Brevoortia Tyrannus*) fishing season (Atlantic Menhaden Advisory Committee, 1982). Under this recommendation, forwarded to North Carolina by the Atlantic States Marine Fisheries Commission (ASMFC), fishing would be prohibited after mid-December.² The ASMFC is charged to recommend fishery management measures to deal with problems common to the states.

The rationale for the shortened-season proposal involved resource conservation. Particular emphasis is placed on reducing the heavy fishing pressure on the menhaden "peanuts", i.e., menhaden less than one year old and which have not spawned. It was felt that continued intense fishing pressure on the resource could reduce the stock to uneconomical levels.

As background, in 1976 representatives of the Atlantic Coast menhaden industry, state marine fisheries management agencies and the National Marine Fisheries Service (NMFS) met in Washington, DC to discuss the status of the industry. Landings had declined sharply from the peaks of the late 1950s and early 1960s. A cooperative interstate Atlantic Menhaden Program was initiated, involving industry, state marine fisheries agencies and NMFS. A board, comprised of state agency directors, industry executives and a NMFS representative, was formed to provide guidance for the program. The Atlantic Menhaden Scientific and Statistical Committee (S&S Committee), with technical members from industry, states and NMFS was appointed and given the task of preparing a management plan for the fishery. The menhaden program has since become a constituent part of the Atlantic States Marine Fisheries Commission's (ASMFC) Interstate Fisheries Management Program. The ASMFC administers the program which is funded by NMFS and includes cooperative management planning for several other Atlantic Coast fisheries.

The menhaden management plan was formally adopted by the ASMFC in October, 1981. At its meeting in May, 1982, the Atlantic Menhaden Management Board considered several management options (developed by the Atlantic Menhaden Advisory Committee (AMAC), successor to the S&S Committee) aimed at guarding against recruitment failure and improving yield-per-recruit. The options in the plan included (1) a one-mile corridor extending southward from Chesapeake Bay which would be closed to menhaden purse seining, (2) a series of mesh sizes designed to promote escapement of the smaller fish in each area, and (3) reducing the fishing season in various areas by various amounts of time. The board adopted a variation of the reduced season which came to be known as "Option 7".

Preliminary analysis of the impact of Option 7, i.e., a shortened season, indicated that catches for the entire Atlantic coast would increase in the long run but that the North Carolina fall fishery, upon which the North Carolina industry depends, would experience a declining catch even after the results of Option 7 had been fully realized. The ASMFC recommendation to North Carolina that it adopt Option 7 did not include any description of socioeconomic impacts on the menhaden fishing industry or related economic and social sectors.

As a result of these factors, the North Carolina Marine Fisheries Commission voted not to take any steps to regulate the menhaden fishery. The staff of the Division of Marine Fisheries (DMF) stated that a study would be done to evaluate the social and economic impacts of a reduced menhaden fishery season in North Carolina.

Purpose

The purpose of this report is to analyze the socioeconomic impacts of a shortened fishing season on the North Carolina menhaden industry and related sectors. Such impacts will be quantified in order to assess the impacts in terms of industry revenue, payroll, employment, and local and regional economic activity. Based on such socioeconomic factors, the overall effect of Option 7 on the industry--either under continued operation at a reduced level, or the cessation of all operations--will be discussed.

Objectives

This report will examine the socioeconomic impacts by accomplishing the following objectives:

- (1) provide a historical review of the North Carolina industry;
- (2) project the catch levels in each year, after Option 7 takes effect, until a new equilibrium is reached;
- (3) project revenue levels in each year and compare to baseline revenues;
- (4) project impacts on regional economic activity, including employment within and outside of the menhaden industry;
- (5) discuss potential labor force impacts related to Option 7; and,
- (6) discuss the feasibility of the industry continuing to operate under Option 7.

Data

Information and data for this report have come from several sources. Data of a secondary nature, from published reports, are attributable to the North Carolina DMF (1982) and NMFS (1963-76). In addition, economic and biological data have come from the ASMFC menhaden management plan. Ms. Sheryan Epperly of DMF interpolated yield per recruit data between the two equilibrium points of the analysis.

Current industry information was made available by the North Carolina menhaden industry. This information, which included revenues, costs, employment and markets, was obtained through personal and telephone interviews with each of the firms currently based, or operating in North Carolina. Because of confidentiality regulations, information specific to any one firm is not made available in this report; only industry totals and averages are cited.

The labor force profile information was obtained from a survey conducted by East Carolina University under subcontract to the National Marine Fisheries Service in 1978.

Historical Review ³

The menhaden industry is one of North Carolina's oldest fisheries. Record keeping began in 1870, from which time the industry has operated continuously. By weight, menhaden is North Carolina's largest fishery, as it is along the Atlantic and Gulf of Mexico coasts and for the United States as a whole. In 1981 North Carolina landings accounted for 15 percent of all U.S. menhaden landings, which in turn accounted for 40 percent of all U.S. landings. North Carolina menhaden landings in 1981 accounted for 36 percent of all Atlantic coast menhaden landings; landings from New Jersey and Virginia accounted for most of the rest.

Historical trends indicate decreases in the number of firms and processing plants operating in North Carolina. As many as twelve plants operated during the early 1900s; presently, there are four plants owned by three firms. Once firms and/or plants cease operation, it appears to be financially very difficult for any new firm to enter the industry with a new plant and equipment. Blomo (1974) has estimated investment costs for a complete plant at \$2-10 million, depending on processing volume, with the basic equipment costing over \$870,000.

Firms in the North Carolina menhaden industry are vertically integrated, that is, the harvesting, processing, and marketing operations are all done by the same company. Menhaden are caught as raw product for the processing operations and the industry sells products--fish meal, fish oil, and fish solubles--which are no longer in the form of whole fish. Because of these two circumstances, the most relevant market level at which to calculate industry revenues is the processor level; the exvessel level has no real meaning in the context of this industry.

Recent menhaden catches in North Carolina show no clear trend (Figure 1). During the last thirty years, the largest catch on record occurred during 1981 and the second largest in 1959. Between 1965 and 1973 landings had a downward trend, bottomed out in 1973 and then had an upward trend. Industry sources cite extremely poor weather during 1972-73 as the reason for a low level of fishing effort resulting in poor catches. Poor recruitment, poor spawning success and a low stock of menhaden (from heavy fishing pressure in the 1960s) are other reasons for this pattern.

The fishing season for menhaden in North Carolina is divided into two time periods. There is the longer summer fishing season which has accounted for most of the landings since 1970; and there is a fall fishery which begins in November and extends into January and accounted for most of the landings prior to 1970. In terms of average monthly landings between the two periods, the fall fishery is the most productive for North Carolina firms. December and January catches account for a substantial portion of annual catches (Figures 2 and 3). Industry sources suggest that in some years menhaden do not become available in commercial quantities in the fall off North Carolina until after mid-December. Therefore, Option 7 could reduce most, if not all, of the fall portions of North Carolina annual catches (Figure 4).

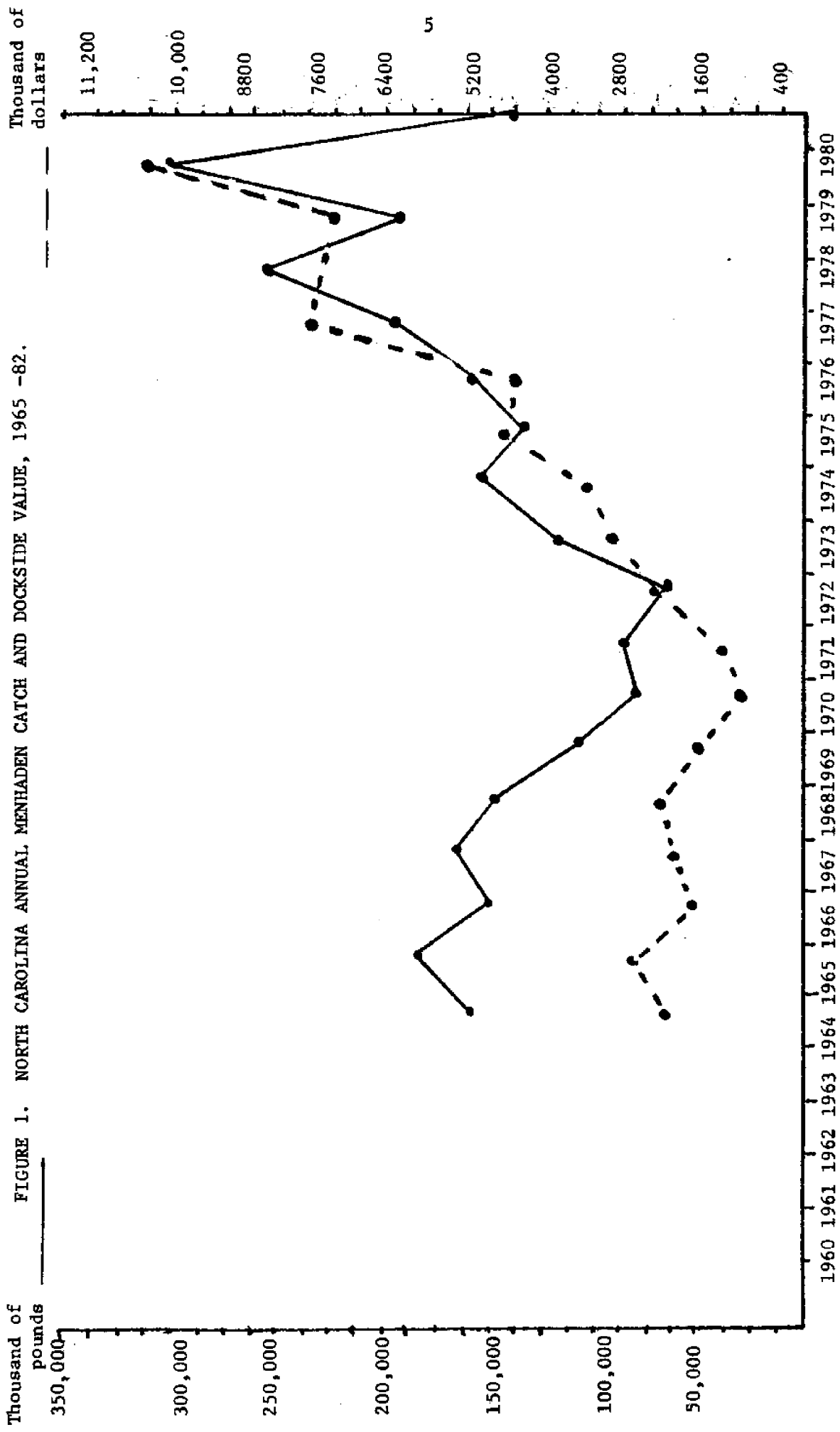


FIGURE 1. NORTH CAROLINA ANNUAL MENHADEN CATCH AND DOCKSIDE VALUE, 1965 -82.

FIGURE 2. AVERAGE MONTHLY CATCH IN POUNDS FOR MENHADEN
IN NORTH CAROLINA, 1975 - 1982.

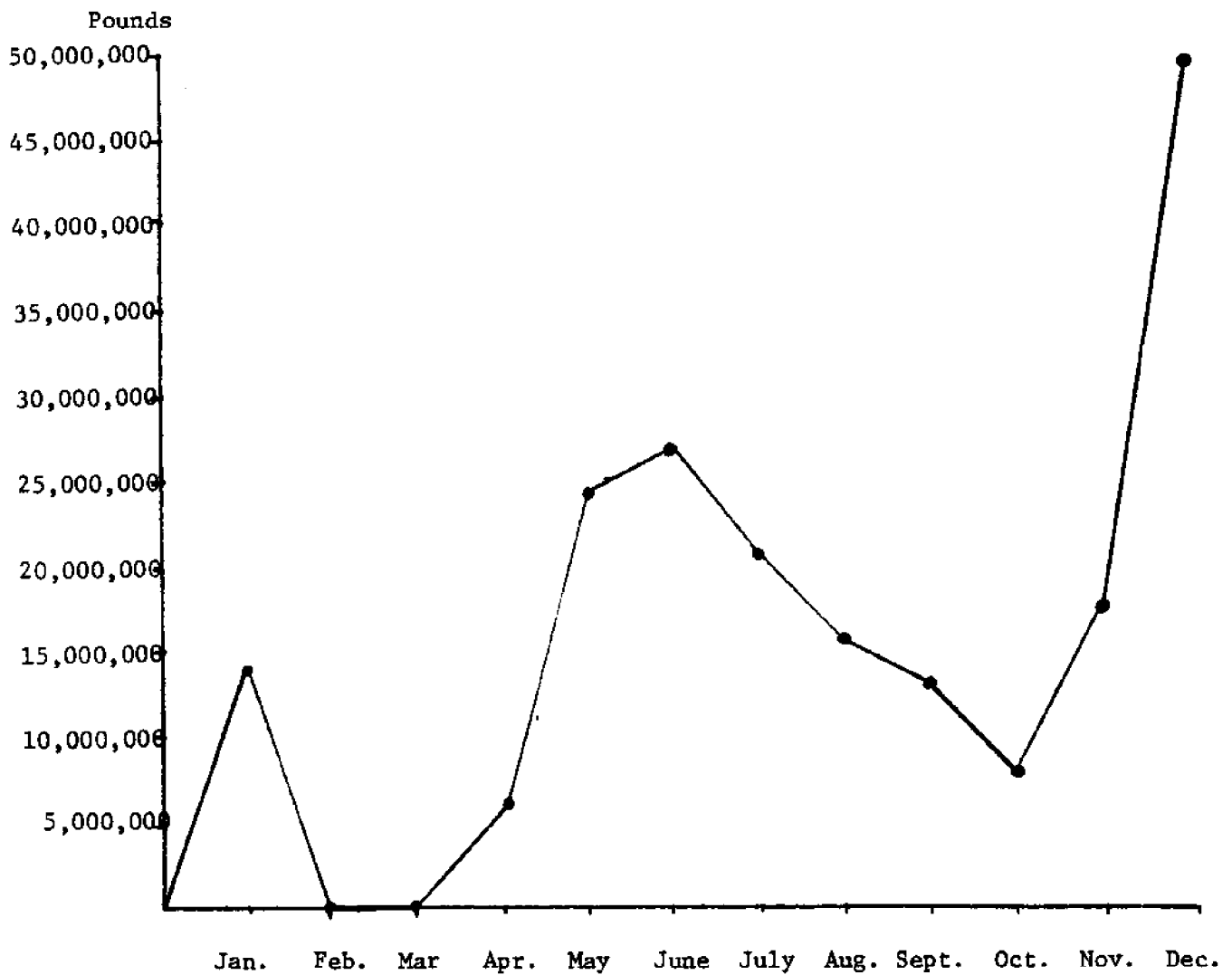
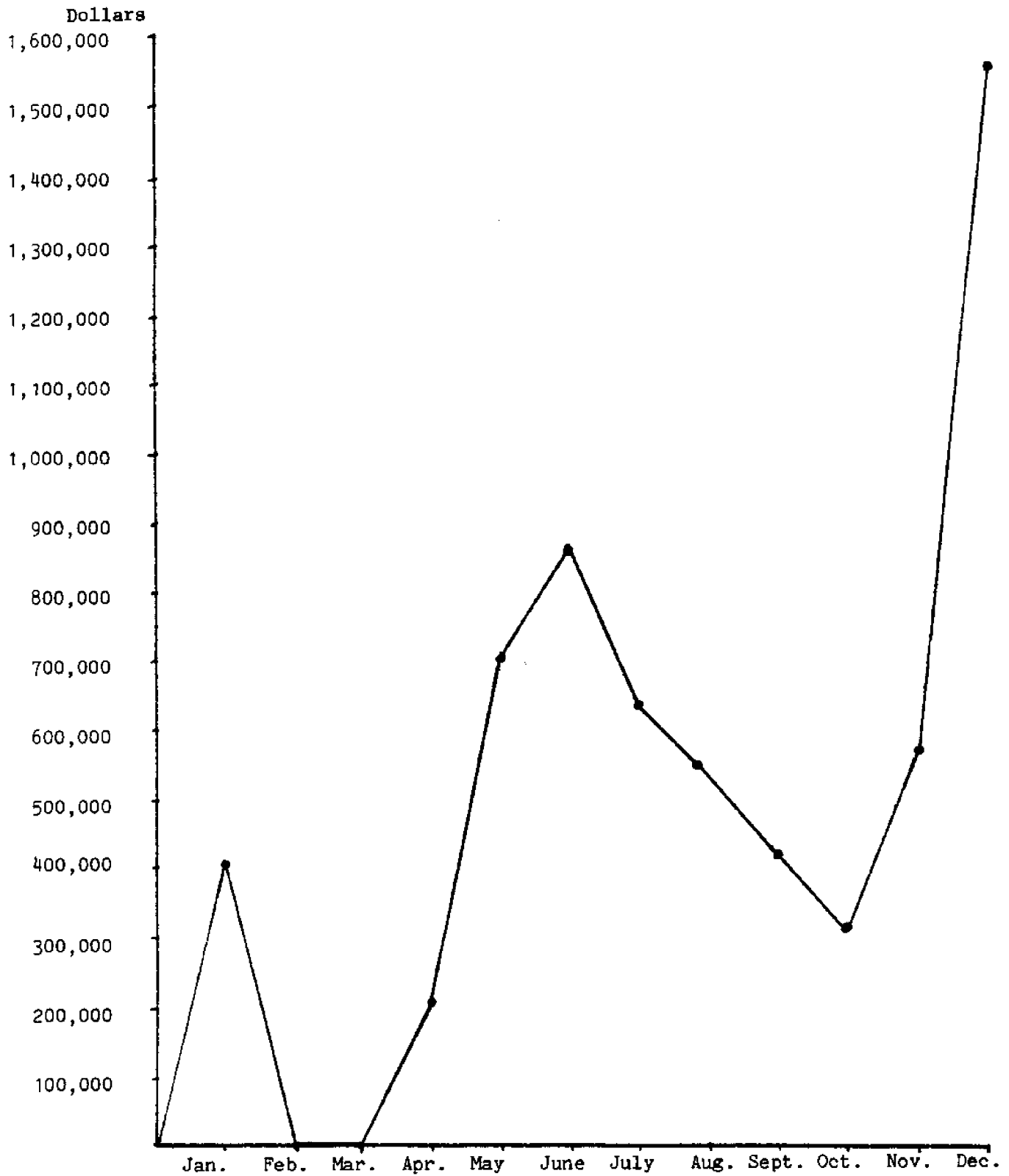


FIGURE 3. AVERAGE MONTHLY DOCKSIDE VALUE FOR MENHADEN IN NORTH CAROLINA, 1975 - 1982



The number of vessels and of fishermen on vessels has been decreasing over time (Figure 5). Reasons for this trend are replacement of older, smaller vessels with fewer, larger vessels; the introduction of hydraulic power blocks which replace labor and manual equipment on the smaller vessels; and widespread use of aircraft to spot schools of menhaden, thus making each vessel more efficient. The result is that the value of the catch is shared among a declining number of fishermen; therefore, each fisherman's share should theoretically be increasing. It is not clear whether or not this has been the case empirically.

The Socioeconomic Region

The North Carolina menhaden industry affects an area larger than simply those two towns where vessels unload and the four processing plants are located (Beaufort and Southport). Menhaden firms buy supplies, provisions and items from other industries throughout North Carolina, and in turn they provide an input to the state's growing poultry industry. In addition, employees of the firms come from surrounding counties as well as the counties in which the plants are located. Therefore, for purposes of this report the area affected by changes in the menhaden industry is the region of counties bounded on the south by Brunswick, on the west by Columbus and Duplin, and on the north by Craven and Carteret (Figure 6).

The areas of the most direct impact would be Carteret, Brunswick, and Craven Counties. It is within Carteret and Brunswick Counties that the four processing plants are located (three in Carteret County), and virtually all the North Carolina employees in the three firms come from these three counties.

Between the three counties, Craven is the largest and most urbanized (Table 1). The city of New Bern is located in Craven County and accounts for a substantial portion of the county population. Many processing employees at the three plants in Beaufort reside in the village of North Harlowe, in Craven County. Since that county also has the largest labor force among the three counties, menhaden-industry employees as a percentage of the total labor force will be small. In terms of new and expanded employment opportunities, Craven County has experienced the greatest growth, followed by Brunswick and Carteret Counties; however, total new and expanded employment opportunities, as a percentage of either total population or labor force, has been greatest in Brunswick County, followed by Carteret and Craven Counties (Table 1). Per capita income follows the Craven, Carteret, and Brunswick pattern from first to third in rank (Office of State Budget and Management, 1981).

Labor Force Profile

The labor force for the North Carolina menhaden industry resides predominately in the counties of Carteret, Craven and Onslow. There are approximately 270 crew positions on the 17 vessels which have operated in the North Carolina waters in recent years, although because of crew replacement, turnover and other factors, the total number of individuals who work on the boats in any given season may be somewhat higher. In addition, there are between 78 and 145 people employed each year in North Carolina in the processing sector of the industry, depending on the season of the year.

FIGURE 4. PERCENTAGE OF TOTAL SEASON CATCH ACCOUNTED FOR BY DECEMBER AND JANUARY CATCHES, 1975-76, THROUGH 1981-82 SEASONS.

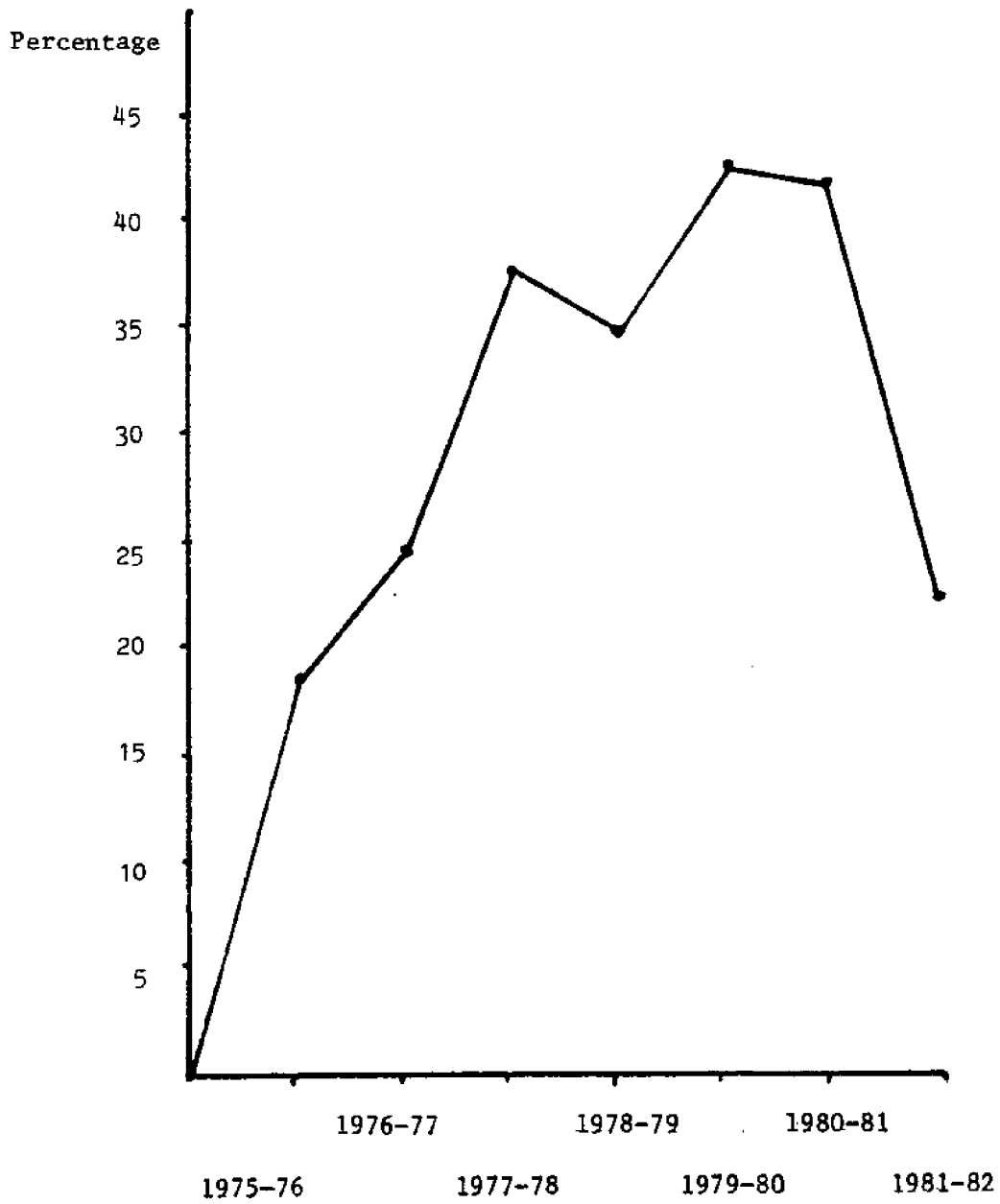


FIGURE 5. NUMBER OF VESSELS AND FISHERMEN ON VESSELS IN NORTH CAROLINA MENHADEN FISHERY, 1964-1976.

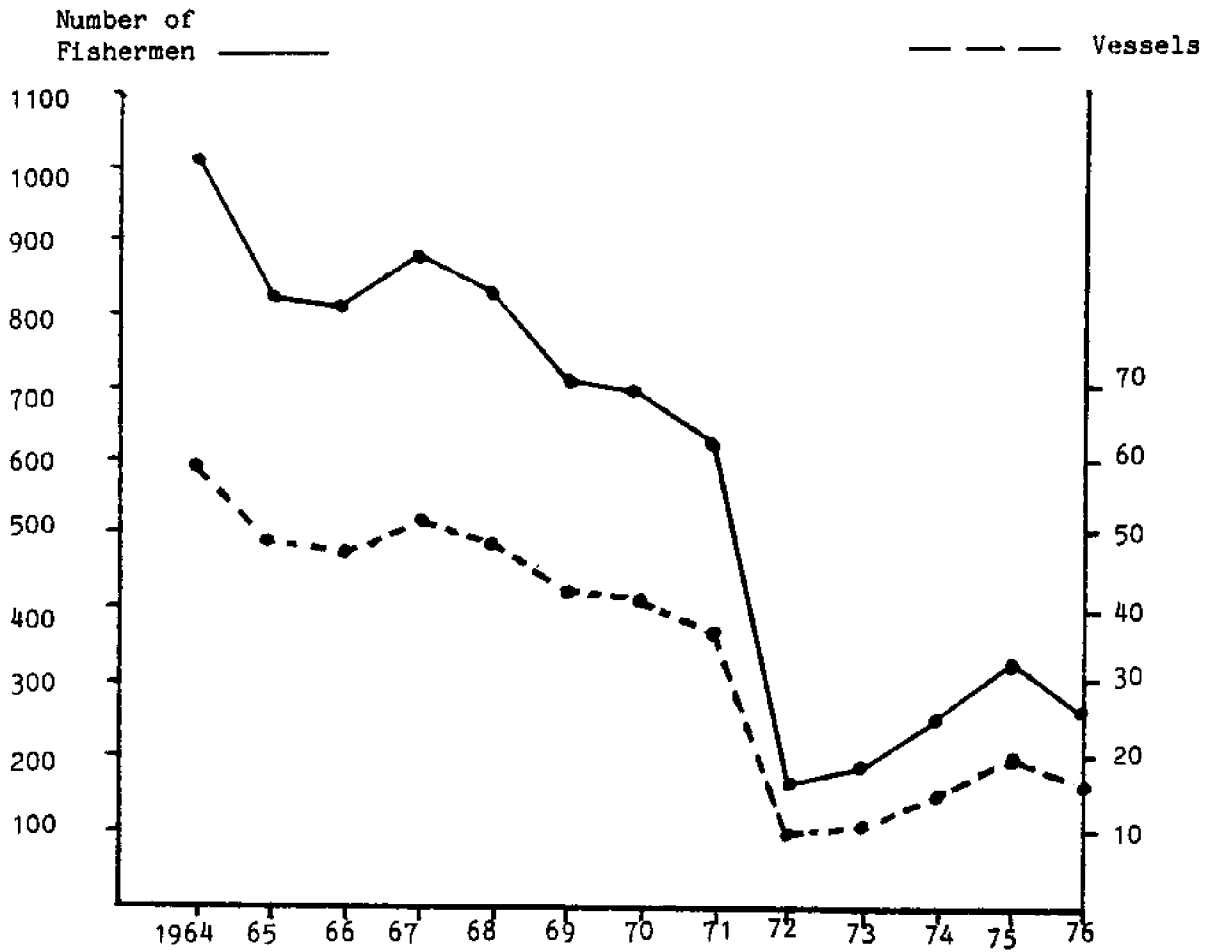


FIGURE 6. MAP OF COASTAL NORTH CAROLINA COUNTIES



Table 1. Demographic characteristics of Craven, Brunswick, and Carteret Counties, 1975-80.

A.

Characteristic	Craven County	Brunswick County	Carteret County
<u>Year</u>			
Total Population			
1975	67,662	32,720	35,632
1980	71,043	35,767	41,090
Total Labor Force			
1975	24,370	14,120	13,550
1979	26,850	15,790	14,920
Per Capita Income			
1975	\$4,714	\$3,486	\$4,323
1979	\$6,893	\$5,598	\$6,545

B. New industry, increased employees in existing and new businesses

Years	Craven County		Brunswick County		Carteret County	
	New	Expanded	New	Expanded	New	Expanded
1960-64	1,245	225	115	0	149	215
1965-69	713	501	550	675	387	377
1970-74	685	100	353	10	243	270
1975-79	194	539	280	557	252	370

Source: Office of State Budget and Management, Research and Planning Services.

C. Monthly unemployment rates in the civilian labor force in Carteret and Craven Counties, 1981

<u>County</u>	<u>Month</u>											
	J	F	M	A	M	J	J	A	S	O	N	D
Carteret	12.1	12.4	10.1	8.3	6.6	5.3	6.2	5.0	5.5	5.7	6.2	7.9
Craven	7.9	7.0	7.0	6.3	5.9	5.6	6.3	6.0	5.5	5.5	5.9	6.1

Source: County Labor Statistics, by place of residence.

The following figures are taken from a survey of 102 menhaden fishermen residing in North Carolina who participated in the menhaden fishery between 1976 and 1978. The distribution of the survey respondents by category of work is shown in Table 2.

The average age of the fishermen in the sample was between 30 and 40 years, with the largest number of respondents being in their 20s (see Table 3). Seventy-one percent were married, 8 percent were widowed or divorced, and 21 percent were single. The vast majority had between 6 and 15 years of education (89 percent), with 47 percent having been to school between 6 and 10 years (see Table 4).

The distribution of annual earnings of these fishermen in 1978 is shown in Table 5. In that year, 93 percent had no other earned income other than that from the menhaden industry; 1 percent had other fishing-related income and 6 percent had other non-fishing-related income. Sixty-eight percent of the respondents owned their own homes.

In the years 1976 to 1978, approximately half of the respondents worked from North Carolina ports and fished in North Carolina waters; approximately one-quarter of the respondents worked out of ports in Louisiana and Mississippi in the Gulf of Mexico; less than 2 percent worked out of ports or fished north of North Carolina. For these same years, an average of 37 percent of the fishermen worked at some point in the year for companies based outside of North Carolina.

Seventy-nine percent of the respondents worked on only one boat in each year; another 6 percent worked on only two boats. Between 1976 and 1978, the percentage of the respondents who did not work on any menhaden boat dropped from 18 percent to 7 percent.

The general profile of the labor force, then, is of a moderately low income group, the majority of whom are in their most productive years but who have little education and few occupational alternatives. They appear to be relatively stable in their community residence (73% preferred to change jobs rather than their residence) and in their association with fishing units. Although the major portion of respondents' income is earned in North Carolina, many of them follow a regular migratory labor pattern primarily involving locations in Mississippi and Louisiana.

Existing Industry Status

For purposes of this analysis, it is necessary to establish a baseline situation with which any changes in the industry as a result of Option 7 may be compared. The analysis will compare the existing situation with all the changes that may be projected with some degree of confidence. The analysis examines the time period theorized by biological scientists for the menhaden population to adjust to a new equilibrium population as a result of a shortened fall fishing season.

Table 2 -- Percentage of respondents by category of work.^a

<u>Category of Work</u>	<u>% of Respondents</u>
Captain	16
Mate	15
Engineer	25
Pilot	24
Cook	9
Crew	75
Processing	11
Fish Spotter	1
Net Mender	7

^aThese figures are from the ECU Survey, in response to the question, "Circle the following types of work you have done in the menhaden industry?"

a. captain	1 yes	2 no
b. mate	1 yes	2 no
c. engineer	1 yes	2 no
d. pilot	1 yes	2 no
e. cook	1 yes	2 no
f. crew	1 yes	2 no
g. processor	1 yes	2 no
h. fish		
spotter	1 yes	2 no
i. net		
mender	1 yes	2 no
j. other	1 yes	2 no

Table 3 -- Age distribution of menhaden fishermen sample.

<u>Age</u>	<u>% Respondents</u>
Under 20	3
20-29	37
30-39	27
40-49	15
50-59	10
60-69	7
70 and above	2

Source: East Carolina University labor force profile survey, under subcontract to National Marine Fisheries Service, 1978.

Table 4 -- Educational level of menhaden fishermen sample.

<u>Years of School Completed</u>	<u>% Respondents</u>
1-5	9
6-10	47
11-15	42
Completed College	2

Source: East Carolina University labor force profile survey, under subcontract to National Marine Fisheries Service, 1978.

Table 5 -- Annual earnings of menhaden fishermen sample from menhaden work and other/unemployment, 1978.

<u>Earning Category/Menhaden</u>	<u>Percentage of Respondents</u>	<u>Percentage of Respondents</u>	<u>Earning Category Other/Unemployment^a</u>
		59	Under 1,000
Under 4,000	19	26	1,000 - 3,999
4,000 - 7,999	34	4	4,000 - 9,999
8,000 - 11,999	18	1	10,000 - 14,999
12,000 - 15,999	11	1	Over 15,000
16,000 - 19,999	4		
20,000 - 24,999	2		
Above 30,000	6		
No Response	7	11	No Response

^aResponse categories for menhaden-related work and other/unemployment were different from one another in the original survey.

Source: East Carolina University labor force profile survey, under subcontract to National Marine Fisheries Service, 1978.

Total North Carolina Catch

Starting with the resource itself, the present (equilibrium) yield per recruit in Area 4⁴ is 8.2705 grams, and in Area 5⁴ it is 5.0707 grams. For the number of recruits of menhaden to the fishery, two estimates are cited from the ASMFC (1982) report on menhaden:

- 5.3 x 10⁹ recruits, the 1973-76 average yearly population size of 0.5-year olds
- 7.2 x 10⁹ recruits, the 1976-78 average yearly population size of 0.5-year olds

Multiplying each area's yield per recruit estimate by the population size will result in a potential harvest for each area depending on the size of the menhaden stock. Converting grams to pounds will result in pounds harvested. The period 1973-76 was a low-abundance period while 1976-78 was a relatively higher abundance period. The results are indicated below:

	<u>Low Abundance</u>	<u>High Abundance</u>
	(Pounds)	
Area 4 catch	96,651,765	131,302,460
Area 5 catch	<u>59,258,714</u>	<u>80,502,345</u>
Total catch	155,919,479	211,804,805

Industry Gross Revenues

The yield and value of fish meal, the primary product from menhaden, is the most important determinant of industry revenue. The other significant menhaden product is fish oil. The industry processes menhaden into regular fish meal through traditional techniques, resulting in a yield of approximately 70 tons per million standard fish units (1 standard fish = 0.667 pounds). An alternative is to combine processed fish meal and fish solubles into a "full meal" product which results in a higher yield per million fish. Both processes are used in the North Carolina industry.

Based on each company's present percentage of total catch, each company's fish meal yield, and a December 1982 price of \$375 per ton, industry fish meal revenue for low and high abundance years are:

	<u>Low Abundance</u>	<u>High Abundance</u>
Fish meal revenues	\$7,333,387	\$9,961,837
Fish meal yield	19,555.7 tons	26,564.9 tons

Fish oil is the other main source of industry revenue. Oil yield depends primarily on the size of the individual fish, the larger specimens containing more oil per ounce of weight. Yield can vary between one and nine gallons per thousand fish, or 2 and 65 pounds per thousand fish. Given the yield range in pounds, the average percentage of zero age fish caught of total individual fish caught (40 percent over 1955-80, from National Marine Fisheries Service data), and a December 1982 price of \$0.12 per pound, industry fish oil revenue for low and high abundance years are:

	<u>Low Abundance</u>	<u>High Abundance</u>
Fish oil revenues	\$893,593	\$1,213,505
Fish oil yield	7,446,611 lbs.	10,112,543 lbs.

Summing fish meal and fish oil revenues results in total industry revenue. For low and high abundance years total industry revenue is:

	<u>Low Abundance</u>	<u>High Abundance</u>
Total industry revenue	\$8,226,980	\$11,175,342

Harvesting Sector Wages and Employment

Harvesting sector wages are the next baseline variable of concern. Crew pay is based almost exclusively on number of fish caught. The average pay scale paid by the three firms is \$5.52 per thousand standard fish units (667 pounds). Based on the percentage of total catch each company accounts for and each company's pay scale, harvesting sector wages for low and high abundance years are:

	<u>Low Abundance</u>	<u>High Abundance</u>
Harvest sector wages ⁵	\$1,331,721	\$1,809,042

Interviews with the three firms revealed a total of 270 crew positions on 17 vessels during the 1982-83 fishing season.

Processing Employment and Wages

The number of employees in the processing plants varies imprecisely with the volume of menhaden processed. There is always a skeleton crew throughout the year in every plant, and employees are added as the fishing season reaches a peak, usually in December of the fall season. The number of processing employees may also vary with the degree of automation in the plants and the pay scale. The most appropriate estimate for processing sector wages, based on interview data for the most recent complete fall season (1981-82), is approximately \$672,000.

An accurate number for total number of processing employees was not available from all three firms; according to the National Marine Fisheries Service (NMFS), permanent year-round employment and peak seasonal employment figures for 1981 are 78 and 145, respectively. Like the harvest workers, not all processing workers are North Carolina residents; some workers maintain permanent residence in Virginia. Because of incomplete information from all three firms operating in North Carolina, a precise classification of North Carolina and out-of-state employees by harvest and processing sectors is unavailable. From interviews with industry sources, perhaps half or more of all employees are North Carolinians.

The Industry's Regional Economic Contribution

The North Carolina menhaden industry contributes to the surrounding region's economic activity. This contribution is a multiple of the industry's value since the industry's products are used in higher-valued products which in turn generate more economic activity. The economic multiplier for prepared feeds for animals and fowls is 1.984 (U.S. Water Resources Council, 1977); that is, a dollar

increase in value of feed produced will generate \$1.98 of gross output (value) in the immediate region. Since fish meal falls into the prepared feed category, it is assumed that the industry has a multiplier of this magnitude.

The industry's contribution to the region depends on how much of its products remain in the region. A review of fish meal production and the North Carolina poultry industry's demands for fish meal indicates that practically all the poultry industry's needs are fulfilled by the North Carolina menhaden industry, depending on use of fish meal in broiler and turkey rations and menhaden abundance. The menhaden industry's excess production over the poultry industry's needs are presented below: ⁶

Poultry Industry Fish Meal Use	Excess Fish Meal Production Over North Carolina Poultry Industry Needs	
	Menhaden Stock	
	Low Abundance	High Abundance
Low	18.1	60.4
High	-12.2	19.3

Based on the above percentages, where the menhaden industry supplies 87.8 percent (100 percent minus 12.2 percent above) to potentially 160.4 percent of the poultry industry's needs, an excess production of 15 percent is arbitrarily chosen. With 85 percent of the fish meal remaining in the region, the multiplier (1.984) is reduced by a factor of 0.85 and then applied to the value of the industry's production. Gross regional economic value attributable to the menhaden industry varies between \$12,367,024 and \$16,799,642, depending on low or high abundance of the menhaden stock.

The contribution of the menhaden industry to employment is also in excess of its own employees. There are two employment multipliers available, neither of which is specific to the menhaden industry or to North Carolina. One multiplier (Centaur Management Consultants, 1975) is an average across the United States for all fishery products. The multiplier (0.49 man years per \$1,000 landed value) can be broken down into the (1) fishing and fishing inputs sector (0.13 multiplier), (2) processing sector (0.21), (3) transportation sector (.01), and (4) wholesaling and retailing sector (0.14).⁸ To use this multiplier, it must be adjusted by the 0.85 factor used above. Only the first three sectors appear appropriate for this industry, and fish meal revenues are adjusted by 0.6 to put them in terms of landed value.⁹ Based on the fish meal revenues above for low and high abundance, the regional employment impacts are:

Sector	Low Abundance	High Abundance
	(man-years)	
Fishing & Fishing Inputs	486	660
Processing	785	1067
Transportation	37	51
Total	1308	1778

The second employment multiplier (Loehman and Hsiao, 1979) is an average across Florida for all fishery products. The multiplier (0.156 jobs per \$1,000 value) can be divided into the harvesting sector (0.101 jobs per \$1,000 exvessel value) and the processing sector (0.055 jobs per \$1,000 processing value).

The employment impact based on this multiplier for low and high abundance of menhaden is:

<u>Sector</u>	<u>Low Abundance</u>	<u>High Abundance</u>
	(jobs)	
Harvesting	444	604
Processing	403	548
Total	<u>847</u>	<u>1152</u>

The main difference between the two employment impacts is in the processing sector. The second multiplier may be more accurate due to the menhaden industry's low ratio of labor per output. The first multiplier may be thought of as the upper limit on employment impacts; employment impacts will be presented in this study using this multiplier for purposes of a worst-case scenario.

Shortened Season Impacts

The yield per recruit model used by the ASMFC indicates that if Option 7 is instituted in Areas 4 and 5 (see footnote 4), then approximately five years will pass in order for the menhaden stock to achieve a new equilibrium yield per recruit size. Presented below is a table indicating how much the yield per recruit size in Areas 4 and 5 would change each year until the new equilibrium in Year 5. There would be no further changes after Year 5.

Yield Per Recruit Changes with Option 7

	<u>Area 4</u>	<u>Area 5</u>	<u>Total</u>
	(grams)		
Present	8.2705	5.0707	13.3412
Year 1	8.2705	2.3719	10.6424
Year 2	8.4814	2.4643	10.9457
Year 3	9.0462	2.6352	11.6814
Year 4	9.2923	2.7091	12.0014
Year 5	9.3456	2.8733	12.2189

The result is that total yield per recruit declines substantially in the first year but starts to increase in the second year; however, by Year 5 total yield per recruit never does regain its former level. The cause for the overall decline is that yield per recruit in the fall fishery (Area 5) declines more rapidly than yield per recruit in the summer fishery increases.

By applying the same procedures used to derive the baseline, the catch, revenue and wage levels can be estimated for each year (1-5) and be compared with the baseline. The changes in catch from the baseline, either high or low abundance, are projected in Tables 6 and 7. Estimates for revenues and wages are expressed in 1983 dollars,

Table 6. Projected changes in North Carolina annual menhaden catches, by area, in a high abundance year under Option 7.

<u>Year</u>	<u>Area 4</u>	<u>Area 5</u> (Pounds)	<u>Total</u>
Present	131,302,460	80,502,345	211,804,805
1	131,302,460	37,656,329	168,958,789
2	134,650,750	39,123,315	173,774,065
3	143,617,380	41,835,465	185,452,845
4	147,524,420	43,008,525	190,532,945
5	148,370,040	45,616,379	193,986,419

Table 7. Projected changes in North Carolina annual menhaden catches, by area, in a low abundance year under Option 7.

<u>Year</u>	<u>Area 4</u>	<u>Area 5</u> (pounds)	<u>Total</u>
Present	96,651,765	59,258,714	155,919,479
1	96,651,765	27,708,030	124,359,795
2	99,116,955	28,799,064	127,916,019
3	105,718,280	30,796,133	136,514,413
4	108,594,050	31,659,390	140,253,440
5	109,217,400	33,578,843	143,796,243

inflation is held at zero, and market conditions for fish meal and labor are assumed to remain constant throughout the analysis.

High Abundance Year

Using a situation of a high abundance year (1976-78 average), total catch begins at 211.8 million pounds, declines to 168.9 million pounds, and eventually settles at 193.9 million pounds (Table 6). Using the current fish meal and fish oil prices, fish meal and fish oil revenues decline by 20.2 percent in the first year and by Year 5 are 8.4 percent less than the baseline (Tables 8 and 9). Therefore, as a result of Option 7, industry revenue will be permanently reduced by 8.4 percent.

Harvest wages are similarly reduced by the same percentage in every year since fish meal and fish oil revenues, and harvest wages, are all based on total catch (Table 10). Processing wages should decline in the fall fishery since catch is substantially reduced; catch in the summer fishery does not increase until Year 2 and then by only 2.5 percent. Therefore, the baseline processing wages in the fall fishery should decline by at least the same percentages experienced by revenues and harvest wages (Table 11).

In terms of regional economic value, during the first year a decline in fish meal revenues of \$2,015,250 would result in a \$3,398,518 decline in regional gross output (Table 12). Based on the Centaur (1977) multiplier the decline in fish meal revenues would result in as many as 360 fewer man-years of employment: 134 in fishing and fishing inputs, 216 in processing and 10 in transportation. Permanent reductions in the menhaden industry's contribution to regional gross output would be \$1,412,782 and in employment of as many as 149 man-years.

Low Abundance Year

Using a situation of a low abundance year (1973-76 average), total catch begins at 155.9 million pounds, declines to 124.3 million pounds, and eventually settles at 143.8 million pounds (Table 7). Using the current fish meal and fish oil prices, fish meal and oil revenues decline also by 20.2 in the first year, \$1,483,929 and \$180,506 respectively (Tables 13 and 14). By Year 5 meal and oil revenues are 8.4 percent less than the baseline, and will remain so permanently (a combined decrease of \$691,903 for both).

Harvest wages are reduced by the same percentages year by year but the absolute amounts are less because of low abundance. In the first year wages are reduced \$269,477, and by Year 5 this decline is \$112,010 (Table 15). Declines in processing wages are projected to decline the same as in the high abundance situation (Table 11).

In terms of regional economic value, during the first year a decline in fish meal revenues of \$1,483,929 would result in a

Table 8. Projected losses in industry fish meal revenues under Option 7 in a high abundance year.

Year & Area	Difference in Catch ^a (Thou. lbs.)	Fish Meal Yield ^b (tons)	Fish Meal Value ^c	Value as a Percentage of Baseline
Year 1				
Area 4	0	0		
Area 5	-42,846	-5,374	-\$2,015,250	
Total ^d	-42,846	-5,374	-\$2,015,250	20.2
Year 2				
Area 4	3,348	420	\$ 157,500	
Area 5	-41,379	-5,190	- 1,946,250	
Total	-38,031	-4,770	-\$1,788,750	17.9
Year 3				
Area 4	12,315	1,545	\$ 579,375	
Area 5	-38,667	-4,850	- 1,818,750	
Total	-26,352	-3,305	-\$1,239,375	12.4
Year 4				
Area 4	16,222	2,035	\$ 763,125	
Area 5	-37,494	-4,703	- 1,763,625	
Total	-21,272	-2,668	-\$1,000,500	10.0
Year 5				
Area 4	17,067	2,141	\$ 802,875	
Area 5	-34,886	-4,375	- 1,640,625	
Total	-17,818	-2,234	\$ 837,750	8.4
Cumulative Five-year Total			-\$6,881,625	

^aCompared to the high abundance year baseline.

^bBased on company share of catch and respective fish meal yields.

^cBased on \$375 per ton.

^dTotals may not add precisely due to rounding.

Table 9. Projected losses in industry fish oil revenues under Option 7 in a high abundance year.

Year & Area	Difference in Catch ^a (Thou. lbs.)	Fish Oil Yield ^b (Thou. lbs.)	Fish Oil Value ^c	Value as a Percentage of Baseline
Year 1				
Area 4	0			
Area 5	-42,846	-2,043	- \$245,128	
Total ^d	-42,846	-2,043	- \$245,128	20.2
Year 2				
Area 4	3,348	160	\$ 19,156	
Area 5	-41,379	-1,973	- 236,735	
Total	-38,031	-1,813	- \$217,579	17.9
Year 3				
Area 4	12,315	587	\$ 70,455	
Area 5	-38,667	-1,843	- 221,219	
Total	-26,352	-1,256	- \$150,764	12.4
Year 4				
Area 4	16,222	773	\$ 92,808	
Area 5	-37,494	-1,787	- 214,507	
Total	-21,272	-1,014	- \$121,699	10.0
Year 5				
Area 4	17,067	814	\$ 97,646	
Area 5	-34,886	-1,663	- 199,587	
Total	-17,818	- 850	- \$101,941	8.4
Cumulative Five-year Total			- \$837,111	

^a Compared to the high abundance year baseline

^b Based on industry's average yield.

^c Based on \$0.12 per pound.

^d Totals may not add precisely due to rounding.

Table 10. Projected decreases in harvesting sector wages under Option 7 in a high abundance year.

Year & Area	Difference in Catch ^a (Thou. lbs.)	Standard Fish Units ^b	Harvest Sector Wages ^c	Wages as a Percentage of Baseline
Year 1				
Area 4	0	0		
Area 5	-42,846	-64,237	- \$ 365,951	
Total ^d	-42,846	-64,237	- \$ 365,951	20.2
Year 2				
Area 4	3,348	5,020	\$ 28,598	
Area 5	-41,379	-62,038	- 353,422	
Total	-38,031	-57,018	- \$ 324,824	17.9
Year 3				
Area 4	12,315	18,643	\$ 106,208	
Area 5	-38,667	-57,971	- 330,257	
Total	-26,352	-39,328	- \$ 224,049	12.4
Year 4				
Area 4	16,222	24,321	\$ 138,553	
Area 5	-37,494	-56,213	- 320,238	
Total	-21,272	-31,892	- \$ 181,685	10.0
Year 5				
Area 4	17,067	25,589	\$ 145,776	
Area 5	-34,886	-52,303	- 297,964	
Total	-17,818	-26,714	- \$ 152,188	8.4
Cumulative Five-Year Total			- \$1,248,696	

^a Compared to the high abundance year baseline.

^b A thousand standard fish is 667 pounds.

^c Based on company share of catch and respective pay scale.

^d Totals may not add precisely due to rounding.

Table 11. Projected decreases in processing sector wages under Option 7.

Period	Decline in Processing Volume ^a (Percent)	Decrease in Wages (dollars)	Total Wages
Baseline ^b	0	0	672,000
Year 1	20.2	-135,744	536,256
Year 2	17.9	-120,288	551,712
Year 3	12.4	-83,328	588,672
Year 4	10.0	-67,200	604,800
Year 5	8.4	-56,448	615,552
Cumulative Five-Year Total		-463,008	

^aCompared to Baseline, high or low abundance year.

^bFall fishery wages, 1981-82 season.

Table 12. Regional gross output and employment impacts attributable to changes in the menhaden industry in a high abundance year.

<u>Gross Output Impact:</u>				
<u>Fish meal revenue decline</u> ^a	<u>Factor</u> ^b	<u>Multiplier</u> ^c	<u>Impact</u>	
Maximum	\$2,015,250	0.85	1.984	-\$3,398,518
Permanent	\$ 837,750	0.85	1.984	-\$1,412,782

<u>Employment Impact:</u>				
Centaur (1975) estimate--				
<u>Sector</u>	<u>Exvessel value^d x 0.85 Factor x Employment Multipliers</u>			
	<u>Maximum Revenue Decline</u>	<u>Permanent Revenue Decline</u>		
	(man-years)			
Fishing & Fishing Inputs	134		55	
Processing	216		90	
Transportation	10		4	
Total	360		149	

Loehman & Hsiao (1979) estimate--				
<u>Sector</u>	<u>Exvessel & Processing Value x Respective Employment Multipliers</u>			
	<u>Maximum Revenue Decline</u>	<u>Permanent Revenue Decline</u>		
	(jobs)			
Harvesting	104		43	
Processing	56		23	
Total	160		66	

^a Compared to the high abundance year baseline.

^b Eighty-five percent of North Carolina-produced fish meal remain in the region.

^c Source: U.S. Water Resources Council (1977).

^d Exvessel value equal fish meal value times 0.6; see footnote 9.

Table 13. Projected losses in industry fish meal revenues under Option 7 in a low abundance year.

Year and area	Difference in catch ^a (Thou. lbs.)	Fish meal yield ^b (tons)	Fish meal value ^c	Value as a percentage of baseline
Year 1				
Area 4	0	0	0	
Area 5	<u>-31,551</u>	<u>-3,957</u>	<u>-\$1,483,929</u>	
Total ^d	-31,551	-3,957	-\$1,483,929	20.2
Year 2				
Area 4	2,465	309	\$ 115,945	
Area 5	<u>-30,460</u>	<u>-3,820</u>	<u>1,432,617</u>	
Total	-27,994	-3,511	-\$1,316,672	17.9
Year 3				
Area 4	9,067	1,137	\$ 426,428	
Area 5	<u>-28,463</u>	<u>-3,570</u>	<u>- 1,338,681</u>	
Total	-19,396	-2,433	-\$ 912,253	12.4
Year 4				
Area 4	11,942	1,498	\$ 561,679	
Area 5	<u>-27,599</u>	<u>-3,461</u>	<u>- 1,297,875</u>	
Total	-15,657	-1,963	-\$ 736,196	10.0
Year 5				
Area 4	12,566	1,576	\$ 591,000	
Area 5	<u>-25,680</u>	<u>-3,221</u>	<u>- 1,207,875</u>	
Total	-13,114	-1,645	-\$ 616,875	8.4
Cumulative Five-Year Total			-\$5,065,925	

^aCompared to the low abundance year baseline.

^bBased on company share of catch and respective fish meal yields.

^cBased on \$375 per ton.

^dTotals may not add precisely due to rounding.

Table 14. Projected losses in industry fish oil revenues under Option 7 in a low abundance year..

Year & Area	Difference in Catch ^a (Thou. lbs.)	Fish Oil Yield ^b (Thou. lbs.)	Fish Oil Value ^c	Value as a Percentage of Baseline
Year 1				
Area 4	0	0	0	
Area 5	-31,551	-1,504,216	-\$180,505.	
Total ^d	-31,551	-1,504,216	-\$180,505.	20.2
Year 2				
Area 4	2,465	117,531	\$14,103.	
Area 5	-30,460	-1,452,199	-174,263.	
Total	-27,994	-1,334,668	-\$160,160.	17.9
Year 3				
Area 4	9,067	432,257	\$ 51,870.	
Area 5	-28,463	-1,356,987	- 162,838.	
Total	-19,396	- 924,730	-\$110,967.	12.4
Year 4				
Area 4	11,942	569,362	\$ 68,323.	
Area 5	-27,599	-1,315,830	- 157,899.	
Total	-15,657	- 746,468	-\$ 89,576.	10.0
Year 5				
Area 4	12,566	599,081	\$ 71,889.	
Area 5	-25,680	-1,224,318	- 146,918.	
Total	-13,114	- 625,236	-\$ 75,028.	8.4
Cumulative Five-Year Total			-\$616,238.	

^a Compared to the low abundance year baseline.

^b Based on industry's average yield.

^c Based on \$0.12 per pound.

^d Totals may not add precisely due to rounding.

Table 15. Projected decreases in harvesting sector wages under Option 7 in a low abundance year.

Year and area	Difference in catch ^a (Thou.lbs.)	Standard fish units ^b	Harvest sector ^c wages	Wages as a percentage of baseline
Year 1				
Area 4	0	0	0	
Area 5	<u>-31,551</u>	<u>-47,302</u>	<u>-\$269,477</u>	
Total ^d	-31,551	-47,302	-\$269,477	20.2
Year 2				
Area 4	2,465	3,696	\$ 21,055	
Area 5	<u>-30,460</u>	<u>-45,667</u>	<u>- 260,158</u>	
Total	-27,995	-41,971	-\$239,103	17.9
Year 3				
Area 4	9,066	13,593	\$ 77,438	
Area 5	<u>-28,463</u>	<u>-42,673</u>	<u>- 243,101</u>	
Total	-19,396	-29,080	-\$165,663	12.4
Year 4				
Area 4	11,942	17,904	\$102,000	
Area 5	<u>-27,599</u>	<u>-41,378</u>	<u>- 235,728</u>	
Total	-15,657	-23,474	-\$133,728	10.0
Year 5				
Area 4	12,566	18,839	\$107,324	
Area 5	<u>-25,680</u>	<u>-38,501</u>	<u>- 219,334</u>	
Total	-13,114	-19,662	-\$112,010	8.4
Cumulative Five-Year Total			-\$919,981	

^aCompared to the low abundance year baseline.

^bA thousand standard fish is 667 pounds.

^cBased on company share of catch and respective pay scale.

^dTotals may not add precisely due to rounding.

Table 16. Regional gross output and employment impacts attributable to changes in the menhaden industry in a low abundance year.

Gross Output Impact:

<u>Fish meal revenue decline</u> ^a	<u>Factor</u> ^b	<u>Multiplier</u> ^c	<u>Impact</u>
Maximum \$1,483,929	0.85	1.984	-\$2,502,498
Permanent \$ 691,903	0.85	1.984	-\$1,040,298

Employment Impact:

Centaur (1975) estimate--

Exvessel value x 0.85 Factor^d x Employment Multipliers

<u>Sector</u>	<u>Maximum Revenue Decline</u>	<u>Permanent Revenue Decline</u>
	(man-years)	
Fishing & Fishing Inputs	98	41
Processing	159	66
Transportation	7	3
Total	264	110

Loehman & Hsiao (1979) estimate--

Exvessel & Processing value x respective Employment Multipliers

<u>Sector</u>	<u>Maximum Revenue Decline</u>	<u>Permanent Revenue Decline</u>
	(jobs)	
Harvesting	90	37
Processing	82	34
Total	172	71

^a Compared to the low abundance year baseline.

^b Eighty-five percent of North Carolina-produced fish meal remain in the region.

^c Source: U.S. Water Resources Council (1977).

^d Exvessel value equal fish meal value times 0.6; see footnote 9.

\$2,502,498 decline in regional gross output (Table 16). Based on the Centaur (1977) multiplier the decline in fish meal revenues would result in as many as 264 less man-years of employment: 98 in fishing and fishing inputs, 159 in processing and 8 in transportation. Permanent reductions in the menhaden industry's contribution to regional gross output would be \$1,040,298 and in employment of as many as 110 man-years.

Costs and Net Revenues

Although industry revenues do decline, part of the industry's costs will also decline from not having to incur the expenses of harvesting and processing after mid-December. Therefore, net revenue losses to the industry will be less than gross revenue losses.

The most recent study of industry costs is the ASMFC menhaden management plan (1981), wherein total costs were apportioned several ways. Total costs were made up of catching costs (57 percent of the total), plant costs (35 percent) and administration (8 percent). Plant and catching costs were broken down into variable, fixed and off-season costs. Further, the various cost components--labor, energy, maintenance and employee benefits--were apportioned among the catching, plant and administrative costs.

Since cost information was not supplied by all three North Carolina menhaden firms, the management plan is used as the basis for estimates of reductions in costs resulting from Option 7. In the absence of more complete information, it is assumed that the intra-firm percentage breakdown of costs cited above for the three firms interviewed for the management plan is representative of cost breakdowns for the three North Carolina firms.

The reduction in catch should reduce only some costs, such as labor and employee benefits, but not others, such as depreciation. The most likely cost reductions with catch reductions would be variable labor costs in catching and in plants, related employee benefits and variable plant energy cost. These costs account for 28.2 percent of total costs. Repair and maintenance and catching energy costs may or may not decline at all. Reducing the 28.2 percent by the fraction of the reductions in catch and calculating the reduction in total costs, net revenue reductions can be estimated (Table 17). They range from 14.5 percent in the first year of Option 7 to 6 percent in Year 5 (and permanently). Net revenue reductions for fish meal and fish oil, in absolute dollar amounts, are indicated in Table 18.

Impacts on the Menhaden Labor Force

Projected impacts on the labor force would depend on the strategies employed by the menhaden firms to deal with the reduced fishing under Option 7. Should the firms presently engaged in the industry in North Carolina remain in business, the impact may be limited to a reduction in wage income commensurate with the general reductions in business activity referred to above, on the order of 20.2 percent in the first year and 8.4 percent at the projected equilibrium level of catch. Should the firms decide to ameliorate this impact by

Table 17. Reductions in total costs, and industry net revenue, under Option 7 in high and low abundance years.

Variable Cost Items	Percent of Total Cost ^a
Labor Costs	
Catching and Processing	16.3
Employee Benefits	3.1
Plant Energy	8.8
Total	28.2
<u>Reduction in catch, percentage</u>	
Year 1	20.2
Year 2	17.9
Year 3	12.4
Year 4	10.0
Year 5	8.4

Reduction in Total cost per year =

28.2% minus 28.2% times (1-percent reduction in catch)

Item	Year				
	1	2	3	4	5
			(Percent)		
Gross Revenue Decline	20.2	17.9	12.4	10.0	8.4
Total Cost Decline	5.7	5.1	3.5	2.8	2.4
Net Revenue Decline	14.5	12.8	8.9	7.2	6.0

^a Source: Atlantic States Marine Fisheries Commission (1981).

Table 18. Reductions in industry net revenue in high and low abundance year under Option 7.

Year	Decline in net revenue ^a	
	High Abundance	Low Abundance
	(dollars)	
1	1,620,425	1,192,912
2	1,430,444	1,053,053
3	994,605	732,201
4	804,625	592,342
5	670,521	493,619
Cumulative Five-Year Total	5,520,620	4,064,127

^a Percent declines taken from Table 17.

reducing the number of employees and thus possibly preserving the income levels of those remaining, the burden of the reductions would possibly fall on the less senior or less experienced portions of the labor force. If the firms were not able to remain economically viable with the reduced catches, the entire labor force would be affected dramatically.

In any of these cases, one must keep in mind that the labor force is characterized by low levels of education and limited occupational alternatives, a high proportion of whom would probably remain in the eastern North Carolina area (gauged by the 73 percent of the interview sample who preferred to change jobs rather than residence). The unemployment rate in November 1982 for the affected counties averages 9.6 percent, and we assume that those employees put out of work by Option 7 would either compete in an already tight labor market or enter the state unemployment roles. In addition, the monthly unemployment rates for the months affected by Option 7--December and January--are already the highest throughout the year (see Table 1.C). Since the residence patterns of the harvesting and processing sector labor force tend to center on a relatively few communities in the affected counties, we would expect the impacts to be concentrated in these communities.

North Carolina Poultry Industry

The impact of a shortened season on the North Carolina poultry industry would be negligible. Based on the average condition that the menhaden industry produces an excess of 15 percent over the poultry industry's needs, it is only in the first and second years of Option 7 that the poultry industry's fish meal needs would not be satisfied from North Carolina fish meal production. In the first year the shortage would be 5.2 percent of its needs, and in the second year 2.9 percent. In the third year and thereafter, chances of a shortage would be small.

With potential shortages, the poultry industry would have to secure fish meal from out of state. Increased transportation costs would be \$5-10 per ton from Virginia and \$17.50 per ton from Gulf of Mexico suppliers. Based on 2.9-5.2 percent of the poultry industry's high and low needs, and the increased transportation costs, increased costs to the poultry industry are:

Increased Transportation Costs for Fish Meal

Shortage	Low need		High need	
	Cost differential		Cost differential	
	\$7.50/ton	\$7.50/ton	\$7.50/ton	\$7.50/ton
2.9 percent	\$2,966	\$6,922	\$3,988	\$9,305
5.2 percent	\$5,319	\$12,411	\$7,150	\$16,685

The poultry industry's other alternative in the event of a fish meal shortage would be to substitute soybean meal. If the poultry industry chooses this alternative, the menhaden industry may permanently lose a part of its market by the third year when it could once again supply 100 percent of the poultry industry's needs. The

implication of this alternative is that the soybean meal industry may gain at the expense of the fish meal industry. Also, in the process of meeting the shortages in fish meal created by Option 7, the increased activity of the soybean meal industry may compensate in the state's economic activity by the same amount of the decline due to the fish meal industry.

Net Regional Impact

The multiplier effect on regional gross output and employment from reductions in the North Carolina menhaden industry revenue under Option 7 would affect the coastal area of North Carolina the most. The overall impact on North Carolina may be as great as described previously if there were no compensating responses to reductions in fish meal availability within North Carolina. However, if the poultry industry makes up the loss in fish meal by substituting soybean meal produced within the state, then the overall impact may approach zero. North Carolina is also a large soybean producing state, and soybeans—a prepared feed for animals and fowl—have a regional multiplier the same as that for fish meal. Thus, a decision to implement Option 7 could mean no change in total economic activity but a redistribution of income and employment from the coast to inland (soybean-producing) areas.

Long-run Industry Survival

Finally, the industry's ability and willingness to withstand such large decreases in revenue, especially in the first two years, and to operate at reduced levels permanently must be examined. The upturn in the fall fishery catches beginning in the second year is predicated on the assumption that menhaden would be harvested from November through mid-December. With catches sometimes beginning only after mid-December, the declines in revenue could be even larger than those indicated. What could result is the industry not participating at all in the fall fishery. In this case, with the industry facing even larger potential losses, one or more of the three firms may cease operation in North Carolina. As noted above, the first two years would be the most critical for this type of decision if Option 7 were implemented.

As in the case of labor force impacts, however, the effects of Option 7 would depend on the flexibility and adaptive strategies shown by the North Carolina menhaden firms. Some of the larger firms may be able to shift their fishing or processing operations to other locations, while the smaller firms most probably could not. The age of much of the capital stock in the industry (notably the fishing vessels and basic plant equipment), the competition for fishing grounds and markets in other areas, legal restrictions, and the high costs of recapitalizing are among the factors which would severely restrict the flexibility of these firms.

FOOTNOTES

- ¹Attributable to the proposed changes in the menhaden fishery.
- ²The actual closing date would vary between December 13 and 19, depending on which day a "fishing week" ended.
- ³Adapted in part from Michael Street (DMF), memorandum of May 24, 1982.
- ⁴Respectively, the menhaden plan designations for the South Atlantic summer and North Carolina fall fisheries. The vast majority of the South Atlantic summer fishery landings are made in North Carolina.
- ⁵Slightly different payment options--such as end-of-year bonuses and guaranteed wages--will result in actual payments to labor varying somewhat from these figures. These figures are, however, adequate for purposes of comparison of impacts in this analysis.
- ⁶See Appendix Table 1 for estimation of poultry industry fish meal demand.
- ⁷Fish oil's value is not included since over 90 percent is exported to Europe.
- ⁸The multiplier describes the employment impact not only in the various levels of fishing industry activity--harvesting, processing, marketing--but also related industries associated with those various levels of activity. For example, related to fishing and fishing inputs are boatyards, marine engine manufacturers, petroleum companies, net material suppliers, etc.
- ⁹The 0.6 factor to put fish meal value in exvessel terms is used by NMFS and DMF for statistical purposes, and is discussed in the management plan (ASMFC, 1981).

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Appendix Table 1. North Carolina Poultry Industry Fish Meal Use, 1981.

<u>Broilers</u>	Low Usage	High Usage
Number raised	423,160,000	423,160,000
Pounds per animal when marketed	x 4.11	x 4.11
Pounds feed per pounds broiler meat	x 2.7	x 2.7
Pounds fish meal per pound of feed	x 0.005	- 0.008
Fish meal use	<u>11,739.5 tons</u>	<u>16,435.3 tons</u>
 <u>Turkeys</u>		
Number raised	26,800,000	26,800,000
Pounds per animal when marketed	x 17.5	x 17.5
Pounds per feed per pound turkey meat	x 2.7	x 2.7
Pounds fish meal per pound of feed	x 0.003	x 0.003
Fish meal use	<u>1,899.45 tons</u>	<u>1,899.45 tons</u>
Total fish meal use	13,639 tons	- 18,334.75 tons
 <u>North Carolina menhaden</u>		
industry supplies available ¹ to poultry industry	<u>Low Abundance</u> 16,109 tons	<u>High Abundance</u> 21,882.8 tons

¹Based on proprietary market information.

Discounting of Economic Values

The declines in industry revenue associated with Option 7 would occur over a period of five full years. The significance of differences in monetary values over time, and by implication differences in catch over time, mean that dollars earned this year are worth more in the future (and dollars earned in the future are worth less this year) because of a discount placed on the time when a dollar is earned. The proper way to compare value over time is to discount each future year's revenue by an acceptable discount factor. This procedure would convert all future values into today's dollars.

The discount procedure, applied to industry revenue in Years 1-5, indicates a reduction in revenue each year (Appendix Tables 2-4). A discount rate of 5 percent was selected. A relatively low rate implies a low discount on future income, that is, future income has a value slightly less than present income. A relatively low rate also implies that little discount is given to future catches, that is, the menhaden stock in the future is given almost as much weight as the present stock. Any discount rate less than 5 percent would bring present discounted values closer to future values. The benefit of using discounted values is to give both fishery managers and the industry a method to evaluate the effect of time on changes to the resource.

Appendix Table 2. Discounted values for declines in fish meal revenue, fish oil revenue, harvest sector and processing sector wages in a high abundance year.

Year	Discount factor ^a	Fish meal revenue ^b	Fish oil revenue ^b	Harvest wages ^b	Processing wages ^b
1	1.05	\$-1,919,286	\$-233,455	\$-348,525	\$-129,280
2	1.1025	-1,622,449	-197,350	-294,624	-109,105
3	1.1576	-1,070,642	-130,237	-193,545	-71,983
4	1.2155	-823,118	-100,122	-149,473	-55,286
5	1.276	-656,544	-79,891	-119,269	-44,238
Cumulative five-					
year total		\$-6,092,039	\$-741,057	\$-1,105,436	\$-409,892

^aThe basic discount rate is 5 percent.

^bRevenue and wage declines per year taken from Tables 8-11; revenue and wages divided by discount factor.

Appendix Table 3. Discounted values for declines in fish meal revenue, fish oil revenue, harvest sector and processing sector wages in a low abundance year.

Year	Discount factor ^a	Fish meal revenue ^b	Fish oil revenue ^b	Harvest wages ^b	Processing wages ^b
1	1.05	\$-1,413,267	\$-171,910	\$-256,644	\$-129,280
2	1.1025	-1,194,260	-145,270	-216,872	-109,105
3	1.1576	-788,055	-95,860	-143,109	-71,983
4	1.2155	-605,673	-73,694	-110,019	-55,286
5	1.276	-483,445	-58,799	-87,781	-44,238
Cumulative five-					
year total		\$-4,484,700	\$-545,534	\$-894,425	\$-409,892

^aThe basic discount rate is 5 percent.

^bRevenue and wage declines per year taken from Tables 11, 13-15; revenue and wages divided by discount factor.

Appendix Table 4. Discounted values for declines in industry net revenue in high and low abundance years.

Year	Discount factor ^a	Net revenue ^b	
		High abundance	Low abundance
1	1.05	\$1,543,262	\$1,136,107
2	1.1025	1,297,455	955,150
3	1.1576	859,196	632,516
4	1.2155	661,970	487,324
5	1.276	525,487	386,849
Cumulative five-year total		\$4,887,370	\$3,597,946

^aThe basic discount rate is 5 percent.

^bNet revenue per year is taken from Table 18; net revenue divided by discount factor.

