7-1-1981

Feasibility of Crab Meal Processing in the Chesapeake Bay Region

Thomas J. Murray
Virginia Institute of Marine Science

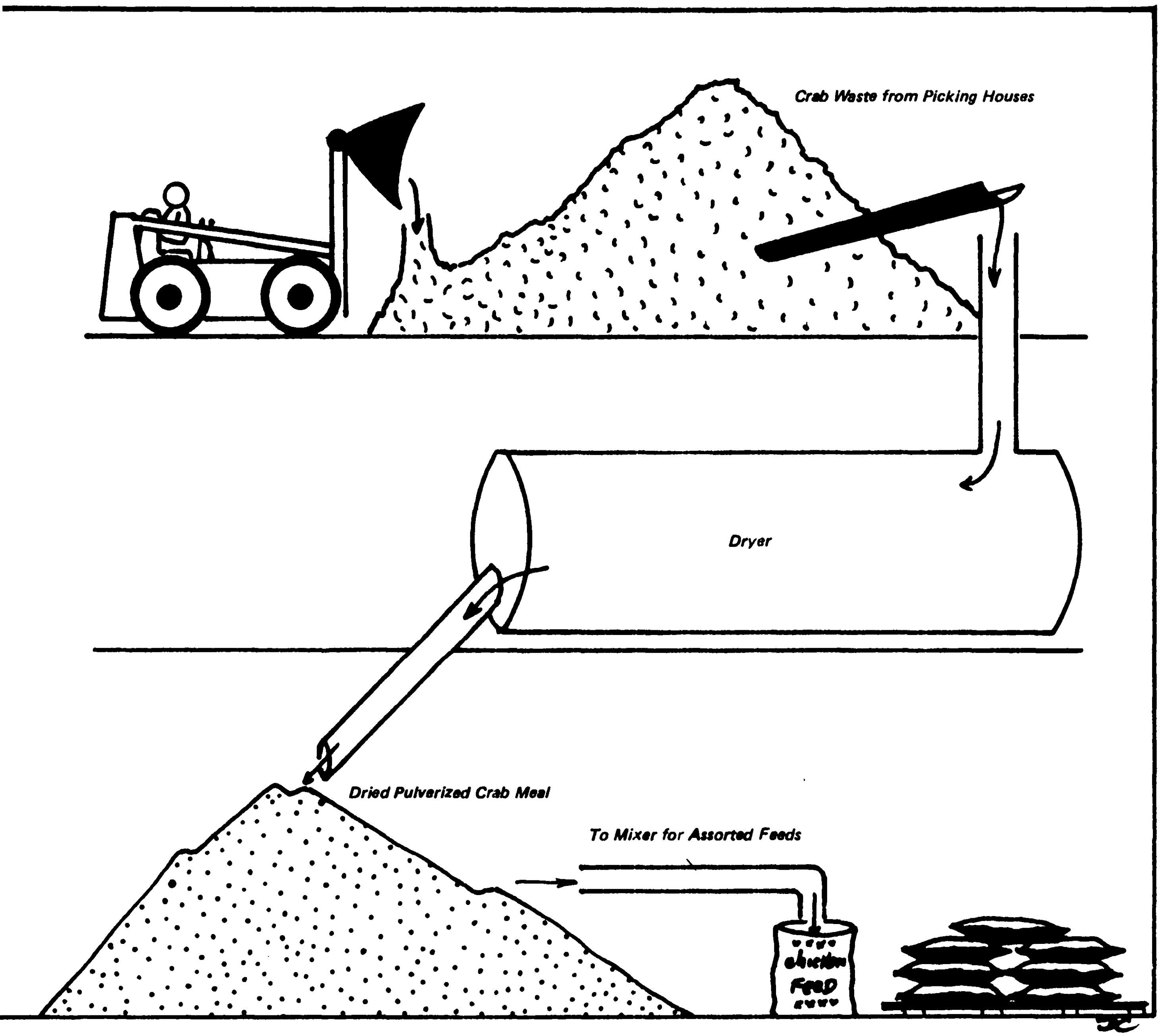
William D. DuPaul
Virginia Institute of Marine Science

Recommended Citation

Murray, T. J., & DuPaul, W. D. (1981) Feasibility of Crab Meal Processing in the Chesapeake Bay Region. Special Reports in Applied Marine Science and Ocean Engineering (SRAMSOE) No. 248. Virginia Institute of Marine Science, College of William and Mary. https://doi.org/10.21220/V5WT8R

Thomas J. Murray
William D. DuPaul

FEASIBILITY OF CRAB MEAL PROCESSING IN THE CHESAPEAKE BAY REGION



SPECIAL REPORT IN APPLIED MARINE SCIENCE AND OCEAN ENGINEERING NO. 248
Virginia Sea Grant Program, Virginia Institute of Marine Science,
College of William and Mary, Gloucester Point, VA 23062

Feasibility of Crab Meal Processing in the Chesapeake Bay Region

Thomas J. Murray
Associate Marine Scientist

and

William D. DuPaul
Senior Marine Scientist

Virginia Institute of Marine Science
College of William and Mary
Gloucester Point, Virginia

Special Report in Applied Marine Science and Ocean Engineering No. 248, July, 1981 Virginia Institute of Marine Science, Gloucester Point, Virginia 23062.

Contract Report No. 10-01-08080, Mid Atlantic Fisheries Development Foundation, Inc. Annapolis, MD 21401

This research was supported by Contract No. 10-01-08080 of the Mid-Atlantic Fisheries Development Foundation, Annapolis, MD and the Virginia Sea Grant Program, Marine Advisory Services at the Virginia Institute of Marine Science, Gloucester Pt., Va.

ACKNOWLEDGEMENTS

This study could have not been completed without significant contributions from numerous individuals and institutions.

Particular credit, however, is due the Mid-Atlantic Fisheries Development Foundation and the Sea Grant Program at the Virginia Institute of Marine Science for funding the study. Special thanks to Mr. Weston Conley, RCV Seafood, Inc., Morattico, Virginia, for acting as the Foundation's liaison on this project and whose assistance was invaluable.

Drafts and final copy of this report were prepared by the Virginia Institute of Marine Science Report Center.

INTRODUCTION

The disposal of hard crab waste generated by Chesapeake Bay blue crab picking operations became an acute industry problem in early 1980. Historically, this very unstable processing scrap had been collected from picking houses, transported to commercial drying facilities and used to produce a dried meal product. Reduced and stabilized crab meal is marketed to producers of livestock feeds as a protein source in a variety of feed products. As an additive to these feed formulas, the crab meal is a marketable recovered waste product (Appendix 2).

In 1980 some crab meal processors had experienced problems in the rendering of hard crab scrap into meal. Reportedly the traditional market for crab meal had become no longer profitable as competitive meal products (principally soybean meal) experienced marked decreases in price. This change in relative prices reportedly caused a shift by feed companies away from crab meal to the relatively cheaper grains.[1]

Crab meal plant operators were faced with a resulting decrease in final price for their crab meal in conjunction with increases in their operating expenses (principally energy). Unable to meet even the

---

[1]Large feed corporations rely upon computerized formulas to frequently substitute different meal products in feed mixes to minimize costs for protein and other requirements. This is critical because fulfilling animal nutrient requirements is a major economic consideration in livestock enterprises. For example, approximately 80% of the variable costs of feedlot beef, 55-60% in swine and 50-60% in dairy and poultry are due to feed costs.

variable costs of operation, some meal plant operators shut down or drastically curtailed operation to a "day to day" basis.

Without the recovery of the crab waste into a meal product, crab packing houses were faced with the dilemma of disposing of large quantities of wet solid crab scrap in order to keep producing crab meat products. In the absence of the ability to manage their solid waste, processors would potentially be forced to halt or curtail production and have to refuse to buy the massive quantities of blue crabs landed by Chesapeake Bay watermen. The failure of a few crab meal processors could impact the entire blue crab industry of the Chesapeake Bay representing thousands of jobs and millions of dollars in income.

Because of this situation, concerned industry people began to examine their waste management capabilities, and question what could be done to regain control of their industry (Appendix 7).

Implicit in most of this questioning was the widespread consensus that reliance upon crab meal drying for handling their wastes was perhaps no longer acceptable. This dilemma gave rise to the following report on the economics of crab meal production and its continued viability for crab waste management in Maryland and Virginia.

THE PROBLEM

Based on an 18 year average (Table I), Maryland and Virginia produce tens of millions of pounds of hard crab scrap in a single year. This material creates unique problems of handling and treatment due to its odor, physical and chemical nature, pest attraction, quantity and limitation of disposal methods (Cato, et al. 1977).

Additional problems arise because of the seasonality and location of landings (Figures 1, 2, 3) and Table II.

TABLE 1

Total Annual Blue Crab Landings
in Lbs. for Virginia and Maryland by Month

Month	Virginia	Maryland	Total
September	5,069,589	4,215,256	9,284,845
October	4,776,336	3,047,887	7,824,223
November	2,202,381	896,099	3,098,480
December	4,199,626	99,133	4,298,759
January	2,705,689	1,133	2,706,822
February	2,040,510	793	2,041,303
March	1,402,438	1,384	1,403,822
April	2,402,127	377,972	2,780,099
May	3,652,328	1,159,042	4,811,370
June	4,677,860	3,028,147	7,706,007
July	5,317,491	5,082,731	10,400,222
August	5,666,528	5,124,676	10,791,204
TOTAL	44,112,903	23,034,253	67,147,156

Source: VIMS Unpublished Data File (1960-1978 Averaged)

Personal Communication: W. A. Van Engel

FIGURE 1 -
PERCENT OF TOTAL ANNUAL HARD CRAB LANDINGS BY MONTH. (1960-1978 Averaged)

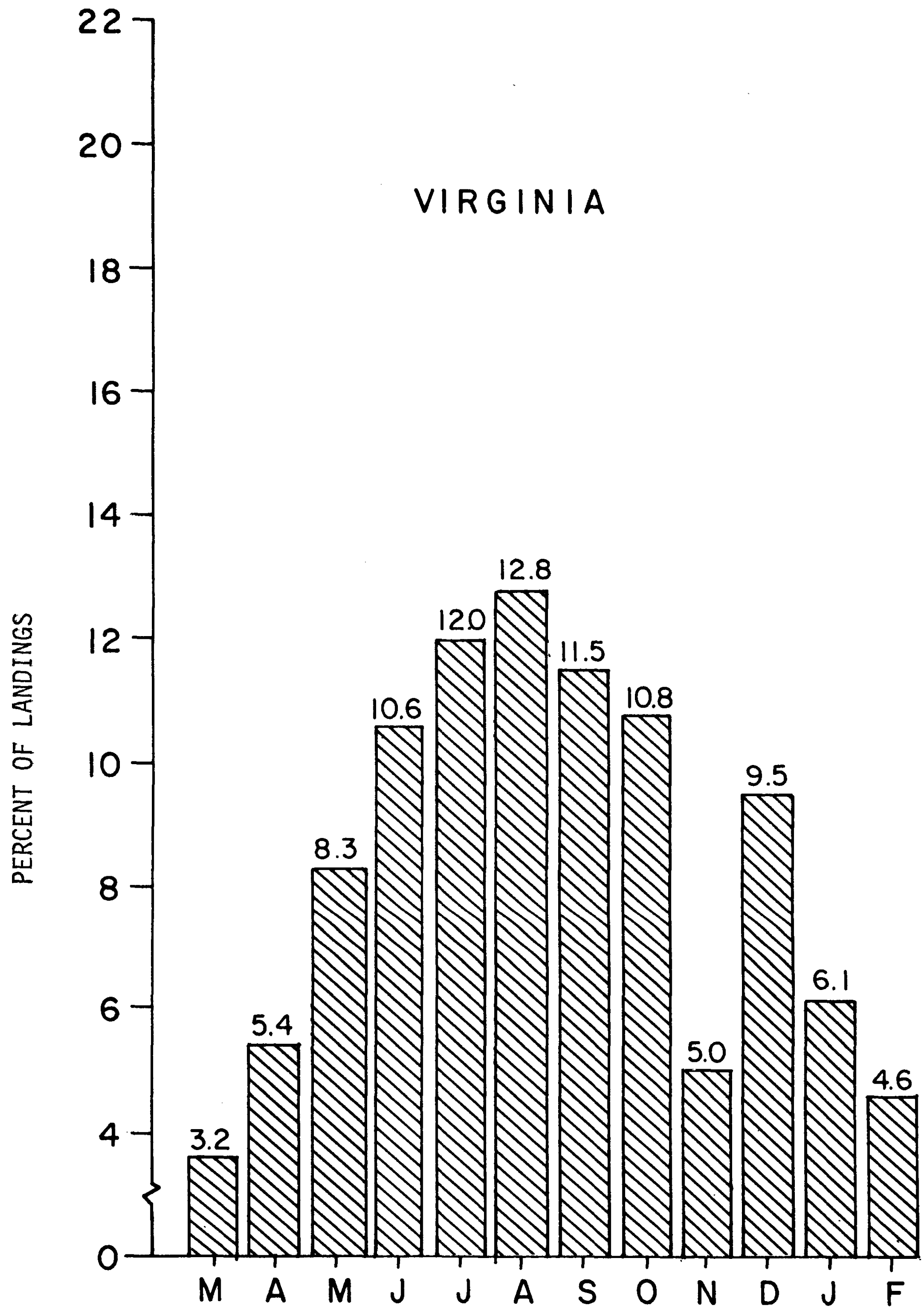


FIGURE 2 -

PERCENT OF TOTAL ANNUAL HARD CRAB LANDINGS BY MONTH. (1960-1978 Averaged)

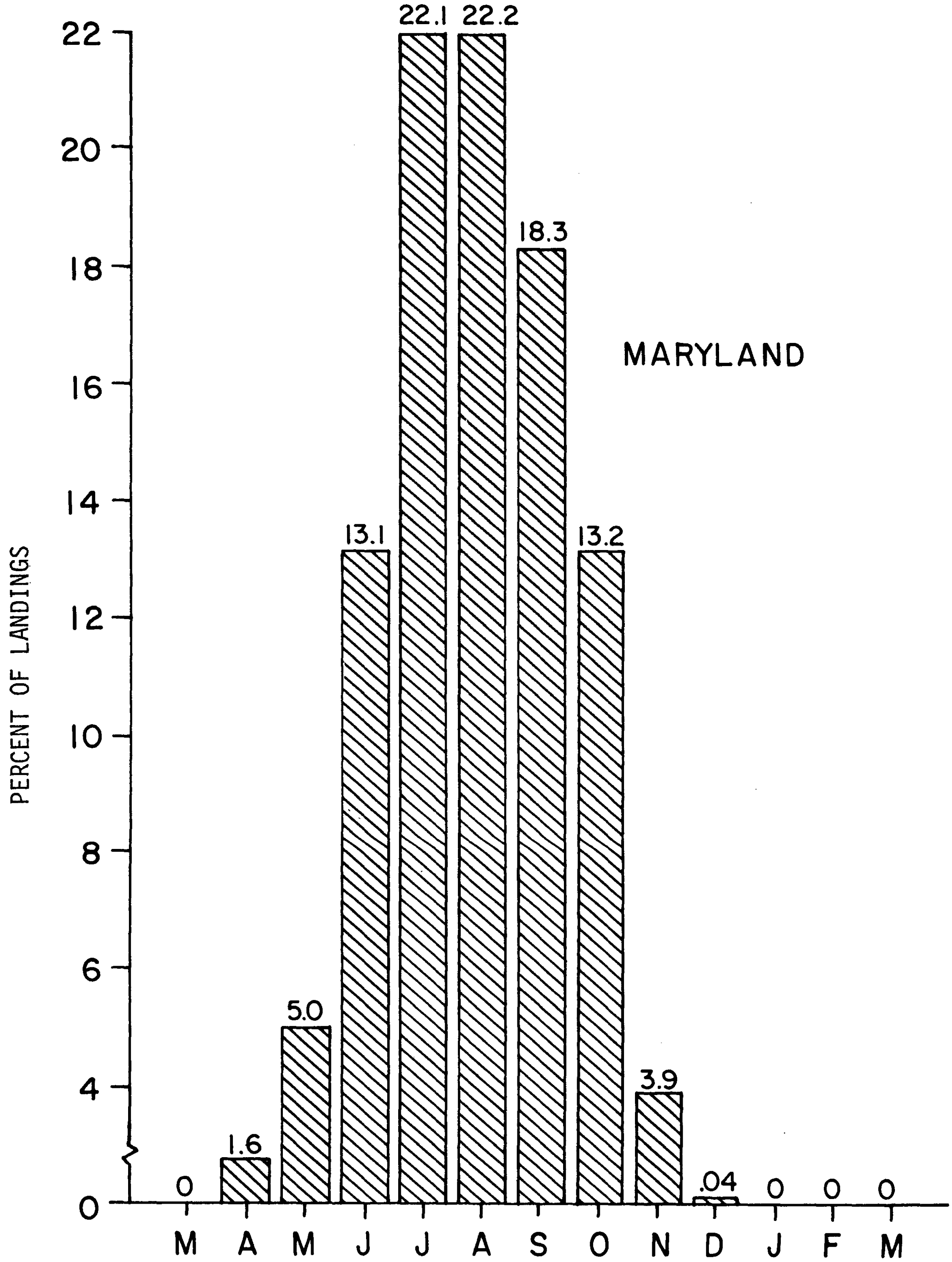
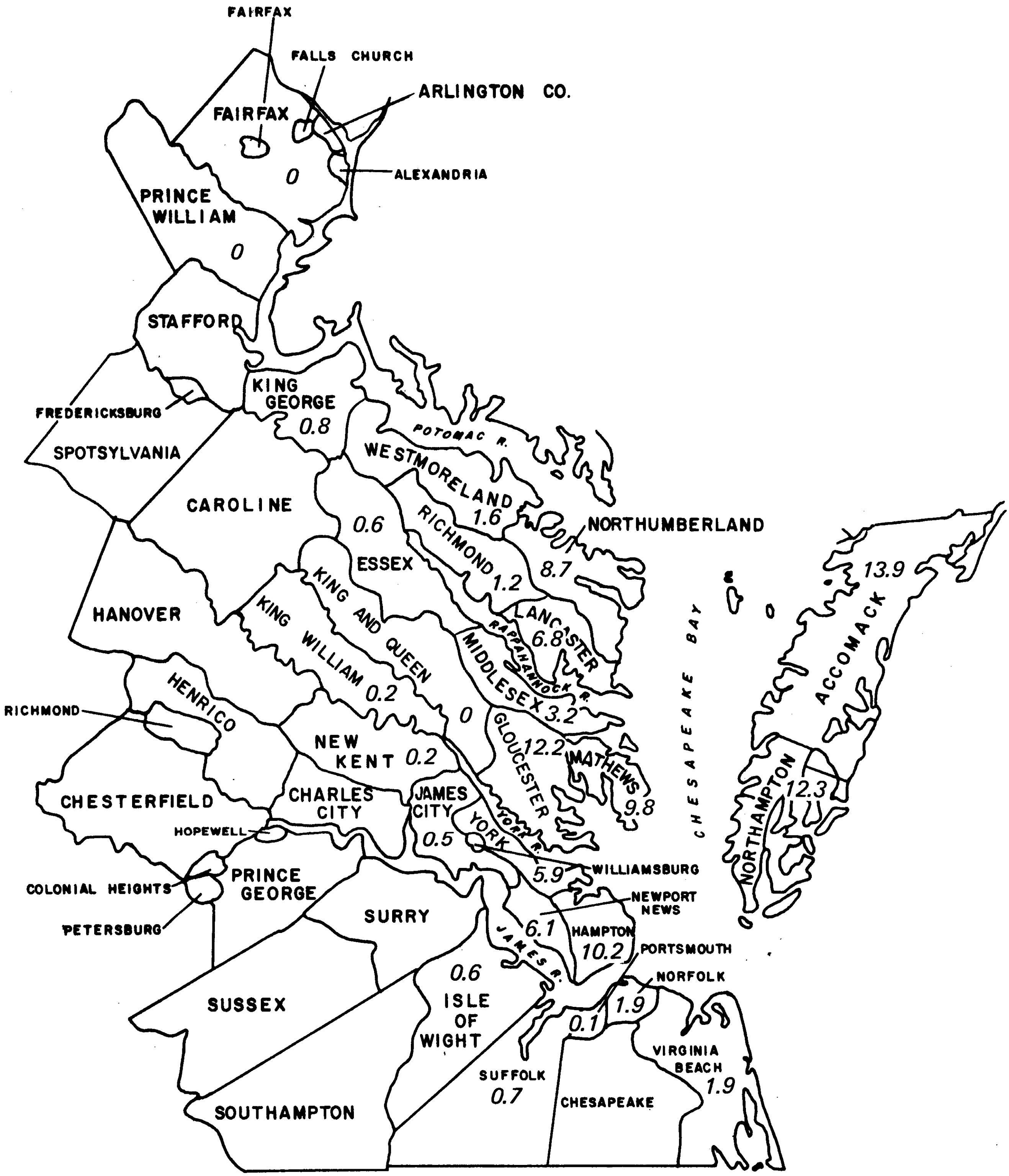


Figure 3

% Hard Blue Crab Landings by County (1963 - 1977 Average)*



* This characterizes the location of Virginia's landings but probably does not accurately reflect the actual processing locations and therefore the true concentrations of hard crab wastes.

TABLE II

DISTRIBUTION OF CRAB PROCESSORS IN MARYLAND BY COUNTY

COUNTY	NUMBER	% TOTAL WASTE
ANNE ARUNDEL		
Annapolis	2	5
CAROLINE		2
Goldsboro	1	
DORCHESTER		36
Crapo	1	
Cambridge	3	
Wingate	2	
Toddville	3	
Fishing Creek	4	
Hoopersville	2	
Crocheron	1	
	16	
QUEEN ANNE'S		9
Grasonville	4	
SOMERSET		30
Crisfield	13	
ST. MARY'S		2
Mechanicsville	1	
TALBOT		14
Sherwood	1	
McDaniel	1	
Wittman	1	
St. Michaels	2	
Bellevue	1	
	6	
WORCESTER		2
Stockton	1	
STATE TOTAL	44	

Source: Maryland Marine Advisory Service.

ENTERPRISE BUDGET FOR CRAB MEAL DRYING FACILITIES

Underlying the crab waste disposal problem has been the widespread assumption that the cost of operating a crab meal production unit and the problems of a limited market disqualify crab meal production as a viable waste treatment option. Because of this assumption, the first section of this report considers the costs and returns of a model crab meal production enterprise.

The budget developed herein depicts: the fixed costs of required drying equipment, buildings, etc.; projected annual costs of operation of three different production levels; summary of the costs, returns and earnings for such an enterprise over one year.

The Heil SD 75-22 dryer (Appendix 1) was selected for this analysis among various sizes and manufacturers for the following reasons:

1. A facility using this same model is in operation in Virginia and therefore management information (not a part of the manufacturer's specifications) would improve budget estimations.
2. This particular drying system is capable of rendering the large quantities of scrap generated at industry centers such as Crisfield and Cambridge, MD and Hampton, VA.

Estimates were made of total fixed costs of operation for the complete dryer system, manufacturer's installation, and a tractor to facilitate scrap handling at the plant site (Table III). The building

TABLE III

Fixed Costs for Crab Meal Plant
Prices for August, 1980

Heil SD 75-22 Dryer Complete (see attached)	$ 42,114.00
Feeder and Infeed Conveyor	19,188.00
Jacobsen Hammer Mill	4,128.00
Rotary Air Lock	4,025.00
Output and Loading Screw Conveyors	9,600.00
Vapor Recycling Duct	5,000.00
Refractory Material	2,300.00
Total Equipment	$ 86,355.00
Mfg. Installation	$ 35,040.00
Total Drying Unit	$121,395.00
Front End Loader (Ford "Bobcat")	$ 9,500.00
Total Equipment	$130,895.00
Bldg. and Grounds[1]	
60' X 80' X 20' (Mitchell) Metal Bldg.	$ 24,000.00
4800 sq. ft. Concrete Slab	4,800.00
Taxes and Insurance	4,000.00
Total Bldg. and Grounds	$ 32,800.00
TOTAL FIXED COSTS	$163,695.00
Labor	
Salary and Fringe Benefits	$ 17,000.00

[1]Industry sources indicate a possible need for additional covered meal storage capacity at larger production levels.

and grounds expenses were estimated by contractors in the Tidewater Virginia area.

Taxes and insurance annual carrying costs, figured at fourteen mills and $10/$1000 respectively, are believed reasonable. Tax rates will vary by location and insurance rates will change with a number of factors such as building materials used, number of personnel, location and age of physical plant.

Fixed labor costs at $17,000 is considered a reasonable salary for a plant manager who will be the primary operator of the drying enterprise. Manufacturer's specifications and processor information indicate that this particular unit is highly automated and may be operated by a single individual. However, annual variable labor costs include an additional worker to supplement the plant operation (Table IV).

TABLE IV

Annual Costs for Three Levels of Crab Meal Production

Fixed Costs	
Depreciation[1]	$ 8,726.00
Salary Mgr.	17,000.00
Principle and Interest [2]	35,849.00
Insurance and Taxes	4,000.00
Miscellaneous	1,500.00
TOTAL FIXED COSTS	$ 67,075.00

Variable Costs	Tons of Production 600	1200	1800
Fuel[3]	13,800	27,600	41,400
Repair and Maintenance[4]	654	1,309	1,963
Electricity[5]	1,424	2,848	4,272
Selling Expense[6]	1,800	3,600	5,400
Office Supplies	500	500	500
Telephone	500	500	500
Labor	7,280	7,280	7,280
FICA (.0613)	446	446	446
Unemployment and Workmen's Comp. (.013)	95	95	95
TOTAL VARIABLE COSTS	26,499	44,178	61,856
TOTAL COSTS	93,574	111,253	128,931

---

1. Depreciation = 20 year for Building.
   15 year for Equipment - IRS Replacement Schedule.
2. Assume 100% Borrowed Capital at 12% for 7 years. 163,695 X (.219) = uniform annual payment based upon the capital recovery formula.

$$A = P \frac{i}{(1 + i)^n - 1} + i$$

   where: P = Loan or Debt.
   i = Annual Compound Interest Rate
   n = Number of Years.
   A = Annual payment required to repay debt with i in n years.
3. Maximum fuel consumption (as per mfg. specifications) = 60 G.P.H. Assume at 65% of capacity consumption = 30 G.P.H. of #2 fuel oil at $1.15/ga. as per processor information. Approximately $34.50/hour of dryer operation.
4. Repair and Maintenance = 1/2% of total equipment cost at 600 tons output. 1% of total equipment cost at 1200 tons output. 1.5% of total equipment cost at 1800 tons output.
5. Electricity at .746 K.W.H./H.P. for 60 H.P. = 44.76 K. W.H./Hr. operation $3.56/Hr. of dryer operation.
6. Selling expense of 3% considered standard for commodities broker.

Average costs for repair and maintenance quoted by the manufacturer were not utilized but rather more pessimistic estimates for repair rates were used herein. Discussions with existing plant operators indicate the graduated rates are reasonable. The simple assumption is that wear and tear on the unit will increase proportionally with use. Repair costs of such a unit depend upon a number of conditions such as quality of operating personnel and equipment maintenance records. Rates used are proportionate to hours of dryer activity.

In annualizing the fixed costs of operation, depreciation was figured using the IRS replacement schedule (20 years for building, 15 years for equipment) using straight line depreciation and assuming a zero salvage value.

The annual principle and interest expenses were figured by assuming all capital required is borrowed at 12% for seven years. The amortization payment of $35,849.00 was figured based upon the capital recovery formula:

$$A = P \frac{i}{P(1-i)^{n} - 1} + 1$$

Where: P = Loan or Debt.
i = Annual Compound Interest Rate.
n = Number of years.
A = Annual payment required to repay debt with interest "i" in "n" years.

Interest is charged for all capital needed irrespective of whether it is borrowed or not. Therefore on any equity the 12% interest represents an "opportunity cost" or foregone return on the capital in some other use.

Projected fuel consumption includes a reported 5-10% reduction in fuel use by installation of the budgeted vapor recycling duct, which also significantly reduces particulate emissions from the facility.

The Heil SD 75-22 Dryer can be adapted for natural gas. According to officials at Virginia Electric and Power Company (VEPCO) use of natural gas would cut the fuel costs by an estimated 35%. However, natural gas is not available at all locations and energy experts expect substantial increases in the cost of natural gas as federal controls are removed, which will theoretically ultimately equalize relative energy input costs.

Because fuel costs have been widely identified as a source of investment risk in a commercial drying operation, further analysis of fuel cost variability and financial impact are considered later in this report. Electrical costs were also figured on an hourly basis as per manufacturer's horsepower specifications. The cost of electricity to run the various motors used by the drying system (totalling 60 h.p.) were figured at .75 K.W.H./H.P.H. and $ .08/K.H.W. (VEPCO).

One element that has been omitted from plant costs is land. Land costs have been ignored because of the following factors:

* The great variability in land values surrounding the Chesapeake Bay. For example, acreages available in Tidewater Virginia, although two miles apart, are being offered at $25,000/acre (waterfront) and $3200/acre inland.
* In terms of total fixed costs, this value will probably be relatively minor and can be an appreciable asset.

The total fixed costs are translated into annualized values along with the strictly operational (variable) costs of production. The fixed and variable costs represent the yearly expenses of producing different volumes of meal.

Enterprise cost data were estimated on the basis of hourly costs of operation by combining the manufacturer's specifications with actual plant data. Production figures derived from actual plant data are projected for operating the plant at 65% of plant capacity (Appendix 1). At this level, 1.5 tons of meal would be produced per hour from approximately 3.5 tons of scrap. Processor derived estimate of a 43% yield of meal from wet scrap was used to specify plant output at the 65% capacity level.[1]

---

[1]Exact yields of meal from wet crab scrap vary considerably depending upon a number of factors such as the physical state of the animal, method of picking, and efficiency of the dryer. More complete drying of scrap material reduces the moisture content of the meal product and thus the yield (conversion factor) decreases. However, because crab meal is valued for its protein, a more thoroughly dried meal having a higher protein content would receive a higher price.

For example, processor information indicates that at a 30-35% conversion rate the meal's protein content would be over 40% and thus the meal would command a higher price.

Generally the conversion factor and protein content will vary inversely. The assumption herein is that percentage changes in meal conversion rates are offset by opposite changes in the total revenue generated from the higher value product.

Thus for the sake of revenue projections herein, 43% conversion to 31% protein meal is considered reasonable.

The costs for fuel, electricity, and maintenance were also figured on an hourly basis. Fuel consumption was budgeted at 65% of the unit's maximum fuel consumption which is rated at 60 g.p.h. Processor information indicates a burn rate of about 30 gallons per hour at 65% capacity.

Fifty three percent of the annual fixed costs are comprised of payments to principle and interest (Table IV). The size of actual cash capital expenses will vary greatly depending upon a number of factors such as actual loan sources and terms as well as the amount of equity capital available (for example: 75% financing at the terms budgeted reduces the average fixed cost expenditure per ton for the smallest scale operation by $30.00 to $82.00).

The model crab meal production facility is characterized by substantial economies of scale with decreasing average total costs per ton throughout the relevant range of production levels (Table IV, Appendix 6, Figure 5). Firms locating in areas without the availability of substantial quantities of crab scrap could consider handling other scrap products locally available to more fully utilize the production capacity of this particular plant. Most modern dryers are adaptable for all grains, agricultural products, meat and seafood products. A smaller scale operation and the availability of used drying equipment would significantly reduce the capital investment. The processing system budgeted in this report was chosen because of its capability to render the great quantities of crab scrap generated

TABLE V

Summary of Costs, Returns and Earnings

Tons of Meal Produced	600	1200	1800
Total Assets	163,695	163,695	163,695
Gross Receipts* ($100/Ton)	60,000	120,000	180,000
Total Variable Costs	26,499	44,178	61,856
Total Fixed Costs	67,075	67,075	67,075
Total Costs	93,574	111,253	128,931
Net Receipts	-33,574	8,747	51,069
% Return on Assets	----	5%	31%
% Return on Sales	----	7%	28%

*Based upon revenues of $100.00 per ton for crab meal.

at processing centers such as Crisfield, Maryland and Hampton, Virginia.

The case studies presented in Appendix 6 include calculations of payback periods. A measure of how quickly required capital outlay may be recovered indicates the potential liquidity of the venture. The payback ability of the crab meal enterprise adds further insight into the risk faced by those considering such an investment.

Enterprise and model plant budgets in Appendix 6 provide a basis for the generation of expected rates of return, cash flow analysis and estimation of capital payback periods. However, capital budgeting is merely a logical method used in business decision-making. The main limitations to such budgeting techniques arise from variables not easily forecast. The following sections deal briefly with some of these variables or the so-called "real world risks" of crab meal production. To date the major problem areas perceived have included:

1. Product marketability and price fluctuations.
2. Energy prices.
3. Transportation costs of scrap from processing plants to the dryer site.
4. Air quality problems.
5. Variability of blue crab abundance.

Product Marketability and Price

Crab meal price, on any given day, is determined relative to the cash price of soybean meal as listed by the Chicago Board of Trade. Industry sources have indicated slightly varying ratios of crab meal prices to soybean meal prices. This is consistent with feed industry representatives who value crab meal for its percentage protein content by weight relative to 44% protein soybean meal. This protein ratio may vary from producer to producer. According to USDA's Feed Regulatory Division, crab meal must contain not less than 25% crude protein (Appendix 2) in order to be acceptable as a feed additive. Crab meal protein content will usually vary from 31% to 44% depending upon the method of crab picking, the natural state of the animal and the efficiency of the dryer.

Communication with feed blenders and commodity brokers have indicated a willingness to utilize meal at the right price. However, there are presently few feed blenders utilizing shellfish meal products in their formulas. The existing market for the product is in relatively small feed blending companies. Minimal quantities of crab meal available limit its use in large scale feed industries; however, to date, all meal produced is marketed.

Commodity brokers familiar with crab meal indicate that increasing the quantity and availability of crab meal will expand its market. Cooperative product storage/marketing by small crab meal producers could improve the marketability of the product and maximize revenues by stabilizing supply and increasing the quantities available. Crab meal will generally comprise a very small additive in standard feed blends, usually 2-3% in laying hen rations. Crab meal should be available in quantity over a reasonably predictable period of time to be included in a feed formulation. Only by being able to rely on an amount and timing of delivery can a blender justify changing his feed formulation to utilize the product as a relatively cheaper source of protein in his feed products.

In addition to the limited available markets for crab meal, chronic price fluctuations are often cited as a serious factor for potential investment in crab meal production facilities. Any product that is priced directly to agricultural commodity prices will face market price fluctuations. Because of the relatively fixed relationship between soybean meal and crab meal, the price path for crab meal will closely follow that of soybean meal (Fig. 4). An investor in such an enterprise must be aware of the potential for price extremes in selling his product. The seasonal price relationships once assumed in feed grain industries may no longer be a certainty. Historically, producers could expect supply induced increases or decreases in soybean meal prices. However, with today's complex market structure, these expected "preharvest upward trends" and "post harvest downward trends" do not always appear. High protein feed grains like soybean meal are important components of international trade and the price functions for these products often reflect "political" parameters in addition to strict supply related phenonema. Classic examples of politically related price changes are the "Russian Wheat Deal" in the early 1970's and the more recent Soviet Grain Embargo of 1980.

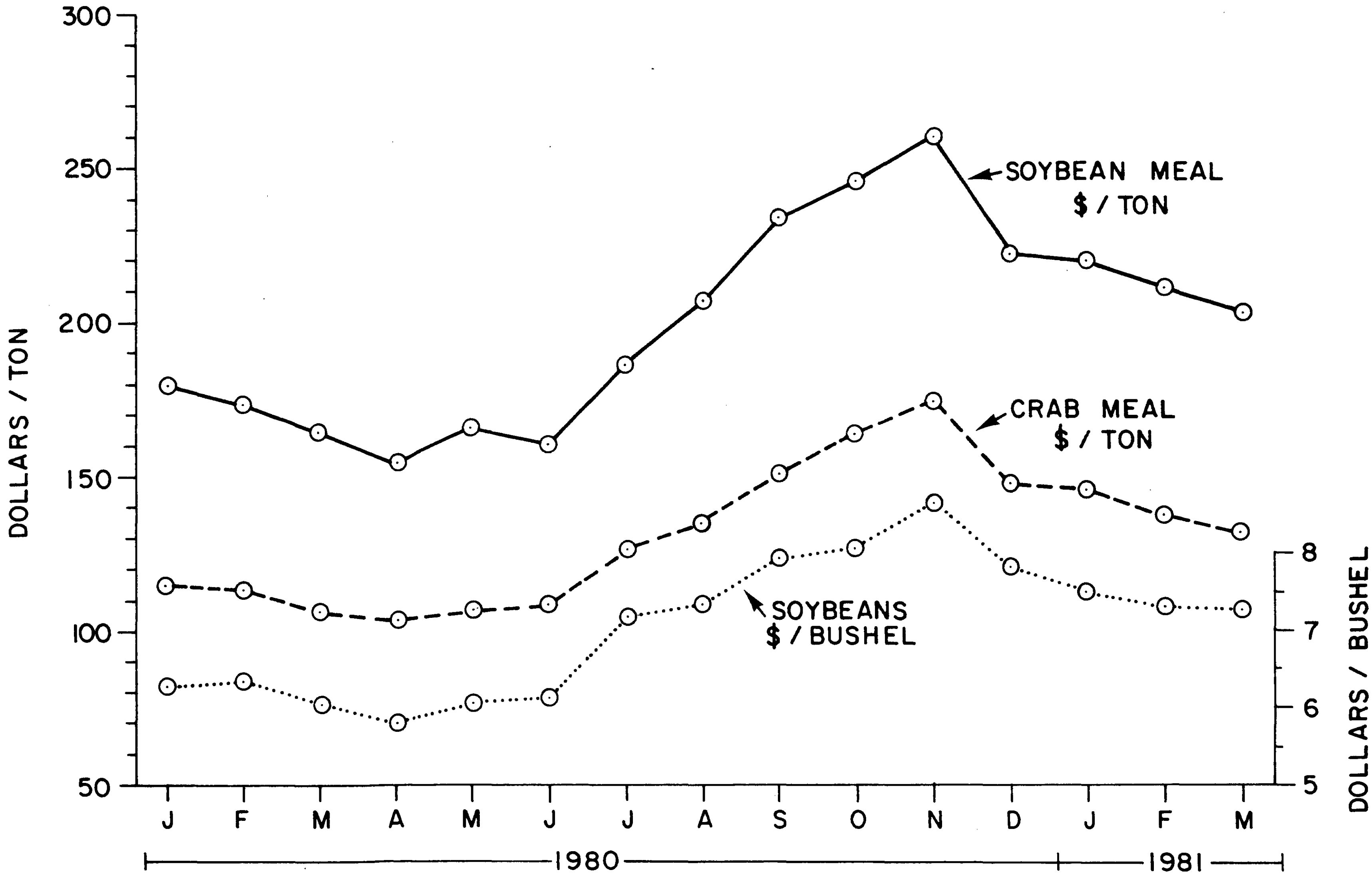
The past two years have represented one of the most volatile periods for the commodities industry. The imposition of the Soviet Grain Embargo caused the price of soybeans, soybean meal (and as a result crab meal) to plummet to historic lows through March, April and May of 1980. Countering this reduced foreign demand was the prolonged drought of the summer of 1980 which restricted agricultural harvests and served to bring soybean prices from their low levels. Prices hit historic highs in November 1980 as the poor harvests were realized (Fig. 4).

There were other significant forces at work in the commodity pricing process and sufficient analysis of this price determination is

FIGURE 4

MONTHLY AVERAGE PRICES

JANUARY 1980 - MARCH 1981



beyond the scope of this report. The investor may view this period as atypical, but indicative of what may happen to the market for crab meal products.

Crab meal presently faces an elastic demand and producers of this product take whatever price is dictated by the commodity situation. However, from an investor's point of view there may also be a substantial benefit in this relationship with soybean meal.

Processed soybean meal prices fluctuate generally along with the price of soybeans (over 90% of the value of a crushed ton of soybean meal is in whole soybeans, Grain Market News, Fig. 4, Table VI). Although soybeans also fluctuate widely in price they do enjoy a price floor or minimum price guaranteed by the USDA. Soybean producers are somewhat protected by these loan guarantee prices. The price support loan rate serves as a government guaranteed buying price if the "free market" equilibrium price drops to the loan level. Farmers who participate in acreage controls and other supply control programs are eligible for these loans. If the loan is not repaid the government takes ownership of the commodity as the security to the loan. The net effect is a price guarantee below which the product (in this case soybeans) price need not fall.

Implicit in this relationship may be a derived price floor for soybean meal even though processed agricultural products may not directly receive loan guarantees. The stabilizing influence on soybean prices would presumably be transferred to the crushed soybean

TABLE VI

Monthly Average Prices
January 1980 - March 1981

MONTH	(F.O.B. Chicago) Soybeans ($/BU.)[1]	(F.O.B. Decator) Soybean Meal ($/Ton)[1]	Crab Meal ($/Ton)[2]
January ('80)	6.22	180.20	115.60
February	6.38	174.25	113.0
March	6.06	164.60	106.5
April	5.80	154.20	103.25
May	6.02	166.50	106.50
June	6.13	160.90	108.45
July	7.19	187.90	126.65
August	7.36	207.40	135.75
September	7.87	234.50	151.35
October	8.06	246.40	163.70
November	8.71	261.40	174.75
December	7.71	223.70	147.45
January ('81)	7.49	220.00	146.60
February	7.32	212.00	137.80
March	7.32	204.30	132.80

[1]Source: Grain Market News - Weekly Summary and Statistics - Agricultural Marketing Service Livestock, Poultry, Grain and Seed Division

[2]Source: Personal communication with Crab Meal Trading Co. Prices F.O.B. Crab Meal Plant for 31% protein.

meal product and thus there probably is some derived or "spin off" lower limit for crab meal.

An investor will face fluctuations in product prices, however for the sake of planning and revenue projections, some lower level of prices may be presumed for the crab meal product. The investor should be aware of this lower limit of revenue and measure the processing plant's feasibility at or around that price level.

Because crab meal is a relatively unique feed additive, some marketing expertise is required to maintain a consistent market demand for the product. Crab meal has found a viable market with laying-hen feed producers and it is highly favored by some of these blenders. However, the investor may do well to use an agent/broker familiar with agricultural commodities for marketing the crab meal product. The added expense of commissions for sale of this product may be insignificant in return for a consistent outlet for a small volume product. Complexities of the commodity market suggest the guidance of a commodities specialist in selling the product.

The rising costs of protein and improved markets for crustacean meals in the aquaculture industry increase the potential use for a product such as blue crab meal. Developmental aspects of crab meal product forms may continue to increase the value of this crab processing by-product. For example, the original producers of crab meal (Hunt Crab Meal Company of Hampton, Virginia and Quinn Company of Crisfield, Maryland) marketed this product solely for the fertilizer industry in the late 1930's. Since that time, pioneering work by Mr.

Theodore S. Reinke has served to increase the value of crab meal. By more refined handling and milling practices, Mr. Reinke's Crisfield Dehydrating Company began to produce a better quality of crab meal product acceptable to the animal feed industry. These advancements created a more lucrative market for the byproduct and, for the last 35 years, most crab meal has continued to be marketed in this same feed blending sector. Continuing improvement in crab meal quality, coupled with a growing interest in specialized product forms (tropical fish foods, aquaculture feeds, etc.), indicates that crab meal may be entering a new stage in its evolution as a specialized feed additive. Long valued solely for its protein content, recent research by food scientists has focused greater attention on other qualities of crustacean waste meals such as carotenoid pigments and trace elements (Meyers 1980).

Further development and increased supplies of crab meal may serve to advance the byproduct to a more specialized market not directly tied to the feed grain sector of the economy.

Most of the limitations discussed above result from pricing and delivering at the time of production - i.e. selling in the spot market. This situation relegates the producer to being strictly a price-taker and has, in some instances, resulted in product storage expenses because of a lack of a ready market. Although there are advantages to such marketing, a new enterprise may wish to consider some type of forward contracting. The crab meal producer may guarantee his market access by contracting in advance for at least a portion of his production. Advance contracting insulates the producer from the risk of volatile product price fluctuation at the time of delivery. The main disadvantage of contracting (advantage of the spot market) is that it reduces the producer's flexibility and one may be unable to take advantage of higher prices prevailing at the time of delivery (Niles, 1979).

Energy Costs

Fuel costs constitute the major component of variable costs for a crab meal drying facility. Fuel represents 52%, 62%, and 67% respectively of variable costs at the three scales of production budgeted (Table IV).

Projecting fuel price increases has become a widely practiced form of forecasting, however, most "official" projections are based simply upon linear trend extrapolations. There is little guidance in these for someone interested in a fuel intensive process such as a drying facility. A fuel price matrix has been developed to display relative impacts of fuel price increases on the variable costs of operation and the average total cost of production of a ton of meal at three levels of production (Table VII). For purposes of analysis, the price of fuel was estimated at $1.15 per gallon. An additional $.18/gallon increase in fuel cost increases the average variable cost of production per ton by about $4.00. The matrix demonstrates the "sensitivity" of production costs to fuel price increases at increments of $.33/gallon. For each $.33/gallon increase in fuel costs, the average variable and average total costs of production increase by about $7.00 per ton of meal produced.*

---

*Differences in cost increments are due to rounding.

TABLE VII

Effect of Fuel Price Increases on the Cost of Crab Meal Production at Three Levels of Production

Average Operating/Variable Costs Per Ton of Output

Fuel $/gal.	600	1200	1800 tons
1.15	44	37	34
1.33	48	40	38
1.66	54	47	45
2.00	61	54	51
2.33	68	60	58

Average Fixed Costs Per Ton of Output (Total Annual Fixed Cost = 67,075)

	600	1200	1800 tons
	122	56	37

Average Total Cost Per Ton of Output at Different Production and Fuel Price Levels

Fuel $/gal.	600	1200	1800 tons
1.15	156	93	72
1.33	160	96	75
1.66	166	103	82
2.00	173	110	89
2.33	180	116	95

A doubling of fuel prices ($2.33/gal.) without an accompanying increase in the price received for crab meal would impact the smaller producer most acutely. However, even at these drastically higher fuel costs and at the lower production levels, the variable costs of operating the dryer would be reclaimed.

There may be a tendency for soybean and crab meal price levels to increase along with the guarantee rates for soybean. Presumably, increases in fuel costs would also be reflected in USDA's loan guarantee rates which are, in part, based on costs of production. Fuel and petrochemical products are a significant component of production costs (fuel and fertilizer comprise about 25% of the production cost of soybeans in the southeast; Westbury, personal communication). Although fuel prices are widely presumed to increase, the values of human protein sources (to which crab meal is related) are also increasing (Appendix 3, 4).

Fuel costs represent the single most significant source of risk for a crab scrap dehydration facility. It is of interest that many of the newer drying systems are adaptable for alternative sources of energy (coal, wood, natural gas). Presumably, this adaptability will at least allow the investor to substitute fuel forms efficiently as energy prices increase in the future.

Scrap Transportation Costs

To this point in the analysis, expenses estimated for the model crab meal enterprise have related solely to those "inside the plant gate" costs of capital and operation. The budget is based upon the assumption that the crab scrap input is available at no cost to the enterprise.

The collection and movement of scrap material to a central drying facility can entail substantial costs. Presently these costs are borne by the crab processors. Whether the scrap is being hauled to landfills or farm land, the processors are paying to have it removed.

Irrespective of the form of ownership of the crab meal facility, the costs of waste pickup will probably continue to be paid by those generating the scrap. Estimates of these costs should be based upon specific plant location which is beyond the scope of this paper. However, in reviewing the costs of transporting scrap to the meal plant, the following should be considered:

1. Processors should view the projected costs relative to those presently being paid for waste removal. Projected costs of scrap transport to the meal plant should not be interpreted as an unambiguous (net) increase in processing operating costs. To analyze these "new costs," one must consider how much they will increase or decrease over present waste hauling expenses. It can be argued that it is more feasible to proximally locate a drying facility to minimize transportation costs than it is a new landfill or farmland.

2. Any net revenues, dividends, patronage fees, etc. realized as a partner, stockholder, coop member, etc. of the new drying facility should be subtracted from these transportation costs.

3. Benefits derived by having access to a continually operational waste disposal site should be considered by those paying transportation costs. Though these 'returns' may be difficult to quantify they are clearly significant or industry would not find itself in its present situations.

For more discussion on this subject see the section on waste disposal alternatives.

Careful consideration of the above points will assist the potential processor/investor in assessing the real changes in profitability as a result of delivering scrap to a crab meal drying facility as opposed to its present destination.

Air Quality Problems

There has been a great deal of discussion regarding the odor and particulate emissions from some existing and recently closed crab meal drying facilities. The greatest problems have arisen from meal plants located in recently urbanized areas. Plants with these problems are typically very old and have no specific air quality control features.

Discussion with representatives of the Virginia State Air Control Board (VSACB) have substantiated these problems, but have also pointed toward relatively reasonable solutions. Advice from appropriate state agencies would be helpful to the potential investor in trying to avoid air quality problems.

According to officials from the VSACB the principle air quality problems stem from two types of emissions:

1. particulates
2. odor

1. Particulate emissions can be reasonably controlled (reduced to meet State and EPA tolerance levels) by the installation of various devices available with modern drying equipment. The enterprise budget presented in this report includes installation of a "vapor recycling duct." In addition to the fuel savings realized, such a duct significantly reduces particulate emission to within permissible levels.

2. Odor problems have been more difficult to control according to VSACB officials because of the nature of the emission. Odor is measurable only subjectively as there are no thresholds or norms as in other types of pollution. Reportedly, odor pollution has only been a problem for plants located close to residential areas. The vapor recycling duct serves to reduce some of the odor in the drying process. However, to avoid problems of odor, VSACB personnel suggest a rural location might be the best preventive step for the potential investor. Reportedly, locating at least a mile from housing developments would be the most judicious

solution to the odor problem. Expedient collection and drying of scrap materials can also serve to greatly reduce the odors at the plant.

Air quality standards need not be a significant source of risk or uncertainty to a crab meal enterprise if the investors will consult the appropriate regulatory agencies for necessary permits and advice prior to location decision-making.

Variability of Blue Crab Abundance

Potentially impacting the crab meal processing firm are the often significant fluctuations in blue crab landings in the Chesapeake Bay. The 1979 data used for projecting landings and waste loads present a relatively low production year for the Chesapeake Bay area. The 1960-1978 averages for the Bay were approximately 67.1 million pounds landed which was somewhat larger than that reported by NMFS for 1979 (64.2 million lbs). Of this total, Maryland landings were above its historic level, (24.8 vs. 23.0 million lbs) and Virginia's was below (39.4 vs. 44.1 million lbs).

The probability of an abnormal production year both above and below the historical average may be expressed statistically (Appendix 8). Annual average landings and variations from the average are important parameters that should be considered in assessing risk factors related to fluctuations of natural resource abundance. The investor may wish to review these fluctuations in blue crab abundance for impacts on projected cash flow, dryer loading, storage capacity, marketing and pay-back periods.

WASTE DISPOSAL ALTERNATIVES

The feasibility of any potential business investment should be measured relative to alternative capital investments and their expected rates of return. Results of capital budgeting herein provide necessary (though perhaps not totally sufficient) information for the potential investor. Ultimately, feasibility is in the mind of the investor.

Economic theory suggests that profit maximizing behavior is the motivating factor in such decisions, however, in this case subjective valuations may differ from conclusions based upon formal capital budgeting.

Not all potential investors have the same perspective. Economic theory assumes the freedom/ability to choose between alternatives in seeking the investment yielding the greatest rate of return. For those actually experiencing crab waste disposal problems the pro forma statements provided should probably be viewed in a different context or with a somewhat different set of assumptions.

Crab processors do not have the same field of choices as an outside or "neutral" investor considering the accompanying budgets. One of the alternatives available to the "neutral" investor is to do nothing. Crab processors with waste disposal problems are not permitted that option.

Major "alternatives" to crab meal processing as a method of waste disposal management include a fairly limited spectrum. To date those options considered by industry have been:

1. Ocean Dumping
2. Sanitary Landfills
3. Direct farmland application

For a complete review of these methods and an excellent summary of seafood waste management see Otwell (1980).

A brief outline of the more salient aspects of these disposal methods will provide the background for evaluating crab meal production as a waste management alternative.

Ocean Dumping/Barging

While such handling would avoid chronic problems of landfill availability there have been several attempts that document problems associated with such handling, generally:

1. Barging is very expensive in terms of obtaining adequate barge and tugboat time.
2. Towboat and barge access points to land are very limited.
3. Weather conditions and sea state dictate ability to transport scrap to the dump site. This dependency makes barging a very undependable disposal technique.
4. Dumping may result in excessively high levels of oxygen demand and turbidity plumes at the dump site.

5. In addition to substantial tug and barge ownership, leasing and operating costs, there are "hidden costs" associated with the required permitting process including analytical requirements, site monitoring and bioassay costs (Champ, 1980).

Sanitary Landfills

Possible advantages:

a. County/local control of crab waste management

b. Known technology

c. Avoid multiple systems with dual management, overhead costs.

Disadvantages:

a. Few suitable landfill sites in coastal areas where crab processing takes place.

b. Need for special handling procedures at the landfill. For example, crab waste requires both a more frequent and thicker cover, smaller waste cells, and requires trench lines of clay or some other material that will resist leaking.

c. Landfill personnel object to nature of waste and the timing of its delivery (mostly at night after a day of crab picking is complete).

d. Reportedly, coastal landfills are presently discouraging crab waste disposal and many have indicated that they will soon refuse to handle crab scrap.

Direct Application to Farmland

Advantages:

a. Extensive areas potentially available with a possible improvement in soil nutrition for field crops.

Disadvangates:

a. Weather dictates access to farmland, and thus may not afford a consistent and timely disposal alternative.

b. Location of a farmland disposal site is critical because of odor problems associated with decaying crab scrap.

c. Potential health hazards from adulteration of ground water, and significant rodent attraction.

Although some of these alternatives may be feasible in specific areas and for relatively small quantities of waste, they are clearly not realistic for the great quantities of waste generated at the three industry centers studied.

In addition to the technical uncertainties alluded to above, experience to date further bears out the unacceptability of these methods of waste disposal. They represent not only very risky short term alternatives but also very expensive options with no possibility of financial return. In short, they represent at best net economic waste and great sources of uncertainty for the crab processor.

In view of such alternatives, the perspective of crab processors considering investment in a crab meal production facility differs from that of the "neutral" outside investor.

In the enterprise budget significant "opportunity costs" are reflected in the expenses of capitalization. It may be that these costs would be different for crab processors investing in the drying facility. Clearly, with their present waste disposal dilemma, opportunities are fewer and it can be reasoned that these lower (or nonexistent) opportunity costs would further enhance the financial feasibility of investment in such an enterprise for crab processors. The enterprise budgets developed also have implications for the profitability of existing blue crab processing firms. Aside from the net profitability of a crab meal facility, processors may also derive additional economies in their processing enterprises resulting from decreased operating costs and/or increased revenues generated by more efficient and dependable processing waste management.

The budgetary analysis herein clearly demonstrates the economic feasibility of crab meal production as an investment opportunity. Reviewing this data in the context of other waste management options, may significantly add to the investment's attractiveness from a crab processors' point of view.

Literature Cited

Bartholomew, David. "Will there be enough Soybeans?" Article appeared in J.A.C.O.S. Journal of America Oil Chemists Society, Vol. 57, #10. 10/80, 754-A-755A.

Boulding, Kenneth E. "Economic Analysis Volume I Microeconomics." Harper and Row, Publishers, N.Y., 1966.

Cato, J. C., Clayton, K. et al. "Report on Alternatives For Managing Solid Crab Waste in Wakulla County." Unpublished reports by Marine Advisory Program, University of Florida, 1977.

Champ, M. A., O'Connor, T. P., Pat, P. K. "Ocean Dumping of Seafood Waste As A Management Alternative." Paper presented at the Conference on Seafood Waste Management in the 1980's. September 1980, Orlando, Florida.

Grain Market News: Weekly Summary and Statistics. Agriculture Marketing Service Livestock, Poultry, Grain and Feed Division, U.S.D.A. Washington, D.C.

Kal Homer, Jukka. "Fish Meal: International Market Situation and the Future." Marine Fisheries Review MFR Paper 1044, Vol. 36, No. 3, Mar. 1974. pp. 36-40.

Mendenhall, M. A. "Utilization and Disposal of Crab and Shrimp Wastes." University of Alaska Sea Grant Marine Advisory Bulletin No. 2, 1971.

Meyers, Samuel P. "Utilization of Shrimp Processing Wastes in Diets For Fish and Crustacea." Paper presented at the Conference on Seafood Waste Management in the 1980's. September 1980, Orlando, Florida.

Murray, Thomas J. "Seafood Waste Management in Virginia." Paper presented at the Conference on Seafood Waste Management in the 1980's. September 1980, Orlando, Florida.

Niles, James A. "Pricing at Delivery." Florida Cooperative Extension Service FRE 18. University of Florida, 1979.

Otwell, W. Steven. "Seafood Waste Management in 1980's: Conference Proceedings Report #40. Florida Sea Grant College, February, 1981.

Paperella, Mike. "Information Tips - To Improve the Processing of Seafood." Marine Products Laboratory, Crisfield, Maryland, 1978.

Perkins, Gary B. "Economic Feasibility Analysis of a Shrimp Waste Processing Plant." Unpublished report for the Extension Food and Fiber Center, University of Mississippi, 1979.

Roberts, Ken. "A Blue Crab Picking Plant Feasibility Analysis For the Blufton, S. C. Oyster Cooperative." Unpublished report.

Schultz, Raymond G. and Robert E. "Basic Financial Management." Educational Publishers, N.Y., 1972.

Tomek, W. G. and Robinson K. L. _Agricultural Product Prices_. Cornell University Press, Ithaca, N.Y., 1972.

Westbury, George O. "Enterprise Budgets: What, How and Why?" Staff Paper 131, Food and Resource Economics Dept., University of Florida, Gainesville Florida, 1979.

Ibid. "Production Costs for Corn and Soybeans" Staff Paper 132, 1979.

HEIL

THE HEIL CO.

3000 W. MONTANA ST., P.O. BOX 593, MILWAUKEE, WISCONSIN 53201, U.S.A.
TELEPHONE (414) 647-3333 • CABLE ADDRESS: HEILCO • TELEX: 026-631

TOM KNOX
7624 Bennington Drive
Knoxville, TN 37919
Telephone (615) ~~619-2494~~ 691-0910

June 23, 1980

Mr. Tom Murray
Marine Advisory Service
Virginia Institute of Marine Science
Gloucester Point, Virginia 23062

Dear Tom:

We certainly appreciate your inquiry concerning our Heil equipment for your crab processing project.

Considering the information we discussed, I am pleased to quote you the following:

HEIL SD 75-22 Dryer:

Including - Burner (gas), furnace, drum, bases, 40 hp fan, ductwork, cyclone, and electric controls

Dryer Complete	$ 42,114.00
Feeder and Infeed Conveyor	19,188.00
Jacobson Hammermill	4,127.76
Rotary Airlock	4,025.00
Installation (no buildings and concrete) . .	35,040.00
TOTAL	$104,494.00

You will note this does not include buildings or concrete. This would probably be done by a local contractor.

I will be in touch with you and if we may be of any service in the meantime, please do not hesitate to call.

Sincerely,

THE HEIL CO.

Tom Knox, District Manager
Dehydration Systems

TK:amk

Enclosures

Appendix 1

Date. December 1. 1976

HEIL DEHYDRATION SYSTEMS

for Municipal, Industrial and Agricultural Applications

THE HEIL CO. Milwaukee, Wisconsin 53201

MODEL SD75-22 DEHYDRATOR

DIMENSIONS:

7'8" wide x 10'0" high x 53'6" long.
See dimension drawing A630F46 for details.

CAPACITY:

Maximum water evaporation rate is 6000# per hour. Rate will vary depending on heat sensitivity of product, its density, original moisture content, uniformity of feed & elevation above sea level. Capacity reduced approximately 6% for each 1000' above 3000'. Dry product capacity estimated on request.

FURNACE & BURNER:

Gas Fired — Direct, end fired, horizontal, cylindrical housing with two support stanchions & material inlet chute. Furnace direct coupled to drum through rotating labyrinth seal. Refractory lining material furnished loose but not installed. Cast-in-place refractory supplied in burner & furnace discharge housing. Four atmospheric venturi type gas burners with 11 M BTU capacity, modulating fuel valve, manual & solenoid shutoff valves, main & pilot lines & pressure gage. Maximum gas consumption 11,000 cfh of 1000 BTU/cu. ft. natural gas. Gas source 15 psi minimum at furnace connection & must be uniform.

Oil Fired (Optional) — High pressure air or steam atomizing gun type main & pilot burners. Includes modulating main fuel valve, manual & solenoid operated shut-off valves, pressure regulating valve & pressure gages. Maximum oil consumption is 60 gph. All grades of oil can be utilized (standard set up for #2 fuel oil). Heavy grades require preheating & Bunker "C" requires steam atomization. 3/4 HP oil pump, oil filter & 7-1/2 HP compressor furnished.

Dual Fuel — Available on request.

Furnished by Others — Fuel supply lines to furnace connections, storage tanks & gas pressure regulator.

CONVEYOR:

Double chain type with steel flights in steel housing sealed against air leaks into furnace, powered from clutch shaft of feeder.

FEEDER:

Semi-automatic, 8'0" x 8'0" floor. Provides uniform feed to dryer. Powered from dryer line shaft. Maximum capacity 700 cu. ft. per hour. Live bottom, variable speed, manually adjusted, feed for handling finely chopped or granular non-corrosive materials having a bulk density less than 60#/cu. ft. Equipped with metal flights on two strand chain, levelling rake & feed reel & collecting screw conveyor with center discharge.

DRUM:

Steel three pass type, 7-1/2' dia. x 22' long, with compound showering flights formed integral with drum shells, positive chain drive, rotary air seal, machined steel running bands.

DRUM BASES:	Fabricated steel with cast iron rollers & ball bearing self-aligning pillow blocks. Drive base equipped with counter shaft, drive & idler sprockets, speed reduction unit & flanged roller for fixed drum alignment. Idler base is equipped with flat rollers for drum expansion.
PRIMARY AIR SYSTEM:	Induced draft, 34" dia. x 16" wide fan wheel. Fan inlet duct equipped with gravity type tramp metals trap. Cyclone collector up-draft type with support & 18" sq. duct between fan & collector.
INSTRUMENTS & CONTROLS:	**Temperature Control** – Outlet air temperature monitored by thermocouple controlling fuel metering valve. Controller is time proportioning constant modulating type. **Safety Control** – Ultraviolet flame failure detector controlling fuel supply, combustion blower air pressure detector, main fan draft detector, high outlet temperature detector. **Indicators** Inlet & outlet air temperature, thermocouple type.
POWER REQUIREMENTS: (Motor starters by others)	Drip proof general purpose ball bearing 3 phase, 60 hertz, 230/460 volt electric motors furnished standard as follows:

Primary Air System –	40 HP	1800 RPM
Drum, Feeder & Conveyor –	5 HP	1800 RPM Powered by line shaft originating at drum drive base. Common drive through line shaft.
Furnace Air Compressor – (Optional)	7-1/2 HP	3600 RPM (Oil fired units)
Oil Pump (Optional) –	3/4 HP	1200 RPM (Oil fired units)

APPROXIMATE NET WEIGHTS

Drum	–	10,000#
Conveyor	–	485#
Drum Bases	–	1,200#
Dryer Collector	–	900#
Firebrick	–	6,000#
Main Fan	–	2,175#
Furnace Housing	–	3,000#
Feeder	–	2,455#
Miscellaneous	–	1,560#

(OPTIONAL) SECONDARY AIR SYSTEM

Dual fan unit in lieu of single primary fan. Single fan base incorporates both primary and secondary fans, driven by one shaft. Fan base encloses motor and V-belt drive.

Primary fan has 34 dia. by 16 wide material handling type wheel, secondary fan has 30" dia. by 6 wide material handling wheel. Fan housings have replaceable liners. Fan inlet has tramp material trap. System includes primary & secondary collector and necessary ducting.

Note milling type secondary fan has 34½ dia. x 6" wide fan wheel.

APPENDIX 2

Composition of Blue Crab (Callinectes sapidus)

	Average	Range	No. of Sources
Chitin	14.	00	1
Protein			
corrected	27.	--	1
uncorrected	31.	28.-35.	6
Ash	39.	29.-50.	5
Calcium	18.	16.-18.	3
Calcium Salts	52.	52.-53.	2
Oil	1.4	0.8-2.9	2
Moisture	6.3	6.0-7.0	4
Undetermined	13.	--	1

Sources: Manning, 1929; Lubitz, Fellers, and Parkhurst, 1943; Tressler and Lemon, 1951; Sure and Easterling, 1952; Morrison, 1956; Lee, Knoebel, & Deady, 1963; Snyder, 1967; Novak, 1970.

Crab Meal is the undecomposed ground dried waste of the crab and contains the shell, viscera, and part or all of the flesh. It must contain not less than 25% crude protein. If it contains more than 3% salt (NaCl), the amount of salt must constitute a part of the brand name, provided that in no case must the salt content of this product exceed 7%. (Adopted 1933.) NRC 5-01-663

APPENDIX 3

Soybeans - No. 1 Yellow
Chicago - Source Grain Market News

YEAR	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	AVG
						Cents per Bushel							
1974-75	757	833	758	728	633	568	556	576	523	515	558	597	634
1975-76	555	497	470	459	465	474	466	471	521	625	664	630	525
1976-77	659	623	658	686	708	725	833	974	950	818	629	566	736
1977-78	521	505	577	587	565	557	653	681	709	679	654	643	611
1978-79	647	676	666	679	685	729	746	730	716	767	749	717	709
1979-80	704	652	638	640	6.221	638	606	580	602	613	719	736	646
1980-81	787	806	871	771	749	732	732						

APPENDIX 4

Soybean Meal 44% Solvent (unrestricted basis) Monthly Average Wholesale Price, Bulk, at Decatur
Source Grain Market News

YEAR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	AVG
						Dollars per Ton							
1974-75	168.20	141.00	143.40	129.20	117.25	117.75	122.00	118.50	120.90	124.00	134.40	133.70	130.90
1975-76	125.90	119.90	125.10	128.25	132.60	127.90	127.10	152.25	187.90	193.90	173.30	179.20	147.80
1976-77	169.60	181.20	197.60	207.00	211.00	226.20	275.60	258.25	225.30	162.00	140.30	143.60	199.80
1977-78	135.00	161.70	160.10	162.20	152.90	179.40	173.00	177.40	169.75	172.00	162.90	163.90	164.20
1978-79	176.80	177.10	188.75	184.90	190.90	194.50	191.10	188.00	209.60	201.60	188.90	188.60	190.10
1979-80	181.40	183.10	188.00	180.20	174.25	164.60	154.20	166.50	160.90	187.90	207.40	234.50	181.90
1980-81	246.40	261.40	223.70	220.00	212.00								

APPENDIX 5

Pounds of picked crabmeat from various areas as reported to National Marine Fisheries Service for the year of 1979. These poundage figures have been translated into live weight pounds and then to solid scrap waste pounds.

	Live Pounds	Meat Pounds	Solid Waste Pounds
Crisfield	5,860,400	703,248	4,102,280
Lower Dorchester	7,537,700	904,533	5,276,390
Cambridge	4,572,250	548,896	3,200,575
Talbot County	1,250,000	150,000	875,000
Totals	19,220,350	2,306,677	13,454,245

Source: Office of Seafood Marketing, Maryland Dept. of Economic and Community Development

APPENDIX 6

The following annual operating budgets have been developed for model crab scrap processing plants in the Hampton, Virginia; Cambridge and Crisfield Maryland areas.

The budgets were developed in a similar manner to that presented in Table II. The scales of operation are based upon the actual availability and seasonality of hard crab waste generated in these industry centers for 1979 (Appendix 5).

The crab meal prices quoted are those which the firms would have received F.O.B. the meal plants for 1980 had they been in operation (Table VI). Fuel costs were estimated at $1.15/gallon which approximates the price at the end of the 1980 production year and thus may be overstated.

Principle and interest payments are similar to those in Table VI. Although 100% financing is probably not possible for such a facility, the overstatement represents the opportunity cost of any equity capital invested. Opportunity cost represents a foregone return on this capital in another use and as such, is a real cost of operation though not purely an "out of pocket expense." For a further discussion of opportunity cost, see the section on Waste Disposal Alternatives.

The three model scrap processing plant budgets provide some hindsight as to what potential investors would have experienced had they made the decison to invest in such construction in the winter/spring of 1980 when the crab waste problem was at its peak.

The production of these model plants is based upon the rendering of 100% of the scrap reportedly generated at these industry centers. These projections are based upon scrap generation for processing plants only and exclude the reportedly significant unprocessed whole crab production in these areas.

Case Study I
Meal Production and Prices By Month 1980-81
(2400 tons total) Hampton, Virginia

	Tons	$/Ton	Total Revenue
March	77	106.50	8,201
April	130	103.25	13,423
May	199	106.50	21,194
June	254	108.45	27,546
July	288	126.65	36,475
August	397	135.75	41,675
September	276	151.35	41,773
October	259	163.70	42,398
November	120	174.75	20,970
December	228	147.45	33,619
January	146	146.60	21,404
February	110	137.80	15,158
	2,394*		323,836

*difference due to rounding $135.00/ton

Case Study I
Annual Costs of Producing 2400 Tons of
Crab Meal at Hampton, Virginia, 1980-81

Fixed Costs	
Depreciation	$ 8,726
Salary Mgr.	17,000
Principle & Interest	35,849
Insurance & Taxes	4,000
Miscellaneous	1,500
Total Fixed Costs	$ 67,075
Variable Costs	
Fuel[1]	$ 55,200
Repair & Maintenance[2]	1,917
Electricity[3]	5,696
Selling Expense[4]	9,715
Office Supplies	500
Telephone	500
Labor	7,280
FICA (.0613)	446
Unemployment & Workmens Comp. (.013)	95
Total Variable Costs	$ 81,349
Total Costs[5]	$148,424

[1] $34.50/hr. of drying x 1600 hrs. drying

[2] R&M (.02) x total capital value

[3] $3.58/hr. of drying x 1600 hrs.

[4] Selling Expenses = 3% total sales

[5] Additional product storage capacity would probably be needed at this scale of operation which would increase somewhat the required capital investment.

Case Study I
Summary of Costs Returns & Earnings
Hampton, Virginia 1980-81

Total Assets	163,695
Gross Receipts	323,836
Total Variable Costs	81,349
Total Fixed Costs	67,075
Total Costs	148,424
Net Receipts Before Taxes (including Depreciation)	175,412
[1]Taxes (Assume Cooperative ownership)	0
Depreciation	8,726
Annual Cash Inflow	184,138

$$\text{Payback Period} = \frac{\text{Net Cash Outlay}}{\text{Annual Net Cash Inflow}}$$

$$.89 \text{ yrs.} = \frac{163{,}695}{184{,}138}$$

[1]Because of the complexities of accurately estimating alternative federal and state tax rates, investment tax credits, for specific forms of ownership, etc, a cooperative form of ownership is assumed eliminating income taxes paid by the enterprise. Taxes would be paid on the dispersal of earnings as patronage dividends to coop members/sponsors. Tax assessments would reduce the annual cash flow and extend computed payback period despite significant business investment tax credits and depreciation allowances.

Case Study II

Meal Production and Prices By Month 1980-81
(880 tons total)
Crisfield, Md.

	Tons	$/Ton	Total Revenue
March	0		
April	14	103.25	1,446
May	44	106.50	4,686
June	115	108.45	12,472
July	194	126.65	24,570
August	195	135.75	26,471
September	161	151.35	24,367
October	116	163.70	18,989
November	34	174.75	5,942
December	0		118,943
January	0		
February	0		
	873*		$135/ton

*difference due to rounding and omission of any minimal landings during December, January, February and March.

Case Study II
Annual Costs of Producing 880 Tons of
Crab Meal at Crisfield, Md. 1980-81

Fixed Costs	
Depreciation	8,726
Salary Mgr.	17,000
Principle & Interest	35,849
Insurance & Taxes	4,000
Miscellaneous	1,500
Total Fixed Costs	$ 67,075
Variable Costs	
Fuel	20,252
Repair & Maintenance	719
Electricity	2,101
Selling Expense	3,568
Office Supplies	500
Telephone	500
Labor	7,280
FICA	446
Unemployment & Workmens Comp.	95
Total Variable Costs	$ 35,461
Total Costs	$102,536

Case Study II
Summary of Costs Returns and Earnings
Crisfield, MD 1980-81

Total Assets	163,695
Gross Receipts	118,943
Total Variable Costs	35,461
Total Fixed Costs	67,075
Total Costs	102,536
Net Receipts Before Taxes (including Depreciation)	16,407
Taxes (Assume Cooperative ownership)	0
Depreciation	8,726
Annual Cash Inflow	$25,133

$$\text{Payback Period} = \frac{\text{Net Cash Outlay}}{\text{Annual Net Cash Inflow}}$$

$$6.5 \text{ yrs.} = \frac{163{,}695}{25{,}133}$$

Case Study III
Meal Production and Prices By Month 1980-81
(2010 tons total)
Cambridge, MD

	Tons	$/Ton	Total Revenue
March	0	0	
April	32	103.25	3,304
May	101	106.50	10,757
June	263	108.45	28,522
July	444	126.65	56,233
August	446	135.75	60,545
September	368	151.35	55,697
October	265	163.70	43,381
November	78	174.75	13,631
December	0	0	
January	0	0	
February	0	0	
	1,997*	0	$272,070

$\bar{x}$ = $135

*difference due to rounding and omission of very minimal landings during December, January, February and March 1st quarter of 1980.

Case Study III
Annual Costs of Producing 2010 Tons of
Crab Meal at Cambridge, MD, 1980-81

Fixed Costs	
Depreciation	8,726
Salary Mgr.	17,000
Principle & Interest	35,849
Insurance & Taxes	4,000
Miscellaneous	1,500
Total Fixed Costs	$ 67,075
Variable Costs	
Fuel	$ 46,230
Repair & Maintenance	1,917
Electricity	4,797
Selling Expense	8,162
Office Supplies	500
Telephone	500
Labor	7,280
FICA (.0613)	446
Unemployment & Workmen's Comp. (.013)	95
Total Variable Cost	$ 69,927
Total Costs	$137,002

Case Study III
Summary of Cost Returns and Earnings
Cambridge, Maryland 1980-81

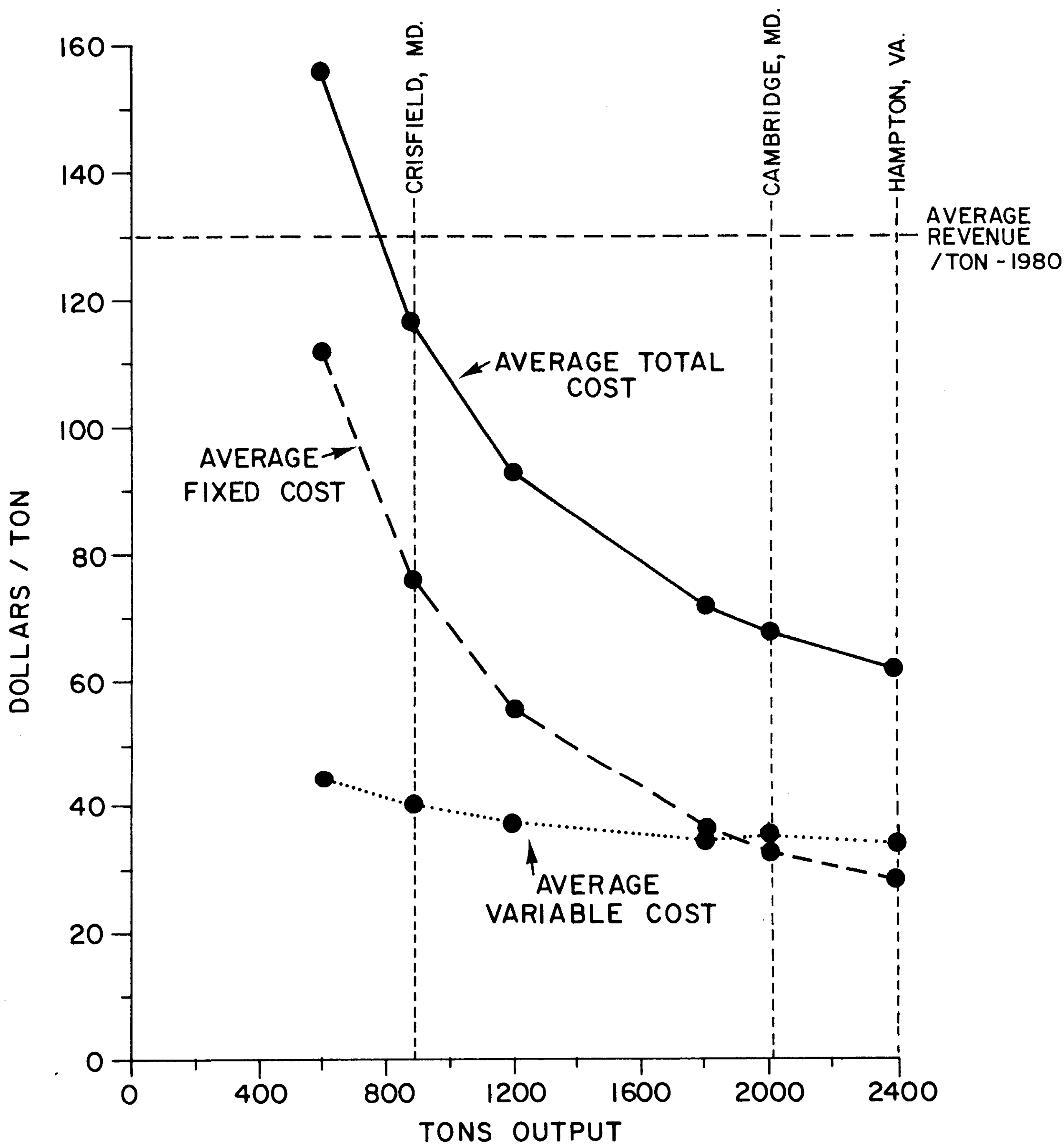
Total Assets	$163,695
Gross Receipts	272,070
Total Variable Costs	69,927
Total Fixed Costs	67,075
Total Costs	$137,002
Net Receipts Before Taxes	$135,068
Taxes (Assume Cooperative Ownership)	0
Depreciation	8,726
Annual Cash Inflow	143,794

$$\text{Payback Period} = \frac{\text{Net Cast Outlay}}{\text{Annual Net Cash Inflow}}$$

$$1.14 \text{ yrs.} = \frac{163,695}{143,794}$$

FIGURE 5

RELATIONSHIP BETWEEN LEVEL OF PRODUCTION AND FIRM COSTS



March 27, 1980

President of the United States
James Carter
Washington, D.C.

Dear Mr. President:

Many consider that I am the last voice and possibly the last hope for finding a solution to the problem that exists in the blue crab industry that could within a few days bring its end. I am sure that you have eaten blue crab. If you have not, you have missed a true delicacy, and you had best arrange to have some soon because it appears that the whole industry will soon be gone. Which is the purpose of this letter.

Certainly you did not intend for the grain embargo on Russia to hurt Americans--you have provided relief to farmers suffering due to the embargo. But you could not have realized how many others would suffer from the embargo including the entire blue crab industry. The grain embargo alone is not killing the blue crab fishery. The kepone incident at Hopewell, Virginia has imperiled all in-shore Virginia fisheries. Natural causes such as successive deep freeze winters in 1977 and 1978 and the salinity changes in the Chesapeake Bay waters from the monsoon-like rains of the Spring of 1979--these have all hurt the blue crab industry. Virginia Institute of Marine Sciences predicts the lowest blue crab harvest in twenty years for 1980.

This letter is about the unavoidable closing of the Lower-Chesapeake Bay Area's only crab waste disposal plant, the largest plant of its kind in the United States. This will cause the closing of 11 crab factories, unemployment for 1000 crab pickers, 100 other factory workers, 200 to 300 watermen, and serious losses to countless additional fisheries-related interests.

Only ten percent of a hardshelled blue crab is edible. The remaining shell, organs, eviscera, etc. must be disposed of in a manner that is acceptable to air pollution and environmental standards. The only acceptable method of disposal and the only alternative throughout the industry is by dehydrating and grinding into meal for blending with other commodities for use as poultry feed. There are presently no other alternatives since it can not be disposed of at sea and is too objectionable to be acceptable to public or private landfills. The plant that is closing in Hampton provides for the disposal of between 5000 and 6000 tons of crab waste per year.

Since processed waste (crab meal) comprises only a small fraction of the total poultry feed ingredients it is eliminated from poultry feed formulae under certain commodities market conditions. The Russian grain embargo has caused this condition now and has depressed the market to a level that is much below processing costs for crab meal even if demand existed.

Although this is a problem that confronts all crab fisheries throughout the Atlantic and Gulf States, it is of disaster proportions to the blue crab industry in the Greater-Chesapeake Bay since it is the largest blue crab fishery in the world.

For more than forty years Hunt Crab Meal Company has provided crab waste disposal service to the Virginia Peninsula blue crab industry. In the past the company has been able to generate modest profits or, at least, perform on a break-even basis. In recent years due to economic conditions and added expenses involved in complying with increasingly stringent pollution control and safety compliance regulations, the company has continued to operate but only through the benevolence and dedication of its owners for the perpetuation of the blue crab industry. Although no less dedicated than ever, the owner's benevolence has now exceeded all bounds that justify or permit sustaining such philanthropy.

Within the past four years Hunt Crab Meal Company owners have sponsored research in other potential by-products from crab waste. The results have been encouraging and, but for the presence of kepone, could have developed into a revolutionary alternative that would eliminate total dependence upon the commodities market.

This Hampton blue crab waste disposal plant must be sustained during the grain embargo in order to save the industry and to permit development of other by-products and alternatives.

My meetings and communications with local, state and federal authorities, despite their grave concern, show no promise as yet of possible remedies or the availability of emergency assistance.

Hunt Crab Meal Company will cease providing services to crab factories on 15 April 1980 per their letter dated March 24 and hand delivered to all eleven crab factories on March 26.

Any attention that may be given to any conceivable source of emergency funding with your administration will be appreciated by countless seafood and fisheries participants and many involved in related interests.

Sincerely,

Kimball F. Brown
Manager, Hunt Crab Meal Co./Box 262/Hampton, VA 23669
Tel. Bus. 804 722 5921-----Res. 804 723 1550

APPENDIX 8

Annual landings (millions of lbs.), Range, Standard Deviation of yearly landings and Coefficient of Variation of Blue Crab Landings, 1960-1978.

	Maryland	Virginia	Total
1961	27.6	43.5	70.6
1962	27.6	53.6	81.3
1963	16.9	46.1	63.0
1964	22.5	51.5	74.1
1965	31.9	50.5	82.5
1966	30.3	63.7	94.1
1967	24.5	54.8	79.4
1968	9.3	44.8	54.1
1969	23.0	33.6	56.6
1970	24.9	42.4	67.3
1971	26.0	47.8	73.8
1972	23.4	48.5	72.0
1973	19.5	36.7	56.2
1974	24.6	40.8	66.5
1975	24.2	34.8	59.0
1976	19.4	24.7	45.2
1977	19.2	37.2	56.4
1978	16.6	36.0	52.6
Average	23.0	44.1	67.1
Range	9.3-27.2	25.7-63.7	45.2-94.1
Standard Deviation (SD)	5.3	9.2	12.7
Coefficient of Variation (CV)	20.9%	23.0%	18.9%

The College of William & Mary

VIMS
SEA
GRANT
PROGRAM