Economic Potential for Utilizing Minced Fish in Cooked Sausage Products

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ABSTRACT—In this paper the economic feasibility of using up to 15 percent minced fish flesh in cooked sausage products is investigated. The cost structures for harvesting and processing walleye pollock and silver hake are examined in detail using alternative modes of production, accounting procedures, and assumptions. For walleye pollock, a catcher/processor operation has the lowest cost structure. Minced fish appears to be price competitive with the middle to upper range of ingredients in frankfurters. Since the nutritional aspects of minced fish are equal or superior to current frankfurter ingredients, a strong potential market appears to exist, although limited in size. The potential market for minced fish will not be large relative to either the cooked sausage market or the allowable level of foreign fishing (perhaps 10 percent in each case). Thus the impacts on both the U.S. fishing and agricultural sectors appear small.

Introduction

The Magnuson Fishery Conservation and Management Act of 1976 (P.L. 94-265) and the American Fisheries Promotion Act of 1980 (P.L. 96-561) combined to establish the legal basis for the conservation and management of most fishery resources within the U.S. Fishery Conservation Zone (FCZ) and in some cases beyond the FCZ to the end of the U.S. continental shelf. The Acts also provide the opportunity for expanding the U.S. fishing industry especially in cases where foreign catch within the U.S. FCZ has been large. Unless domestic markets can be found, however, it is likely that the United States will continue to allocate large quantities of underutilized species to foreign countries for the foreseeable future.

P.L. 94-265 and P.L. 96-561 (together herein referred to as MFCMA) provide a framework for defining and allocating the Total Allowable Level of Foreign Fishing (TALFF). The MFCMA also determines that charges to foreigners for harvesting the resource be at least equal to management and enforcement costs incurred by the United States. Charges imposed on foreigners have included fees for permits, poundage caught, foreign surcharges, and on-board observation. Permit and observer fees reflect administrative costs and are independent of resource value. Since poundage fees reflect a percentage (3.5, 7, or 10 percent) of dockside (or ex-vessel) price of fish actually caught by foreign vessels, these are related to resource valuation. A surcharge when imposed adds a fixed percentage (20 percent in 1981) to poundage and permit fees. Even in the case of poundage fees, it is not clear whether the fee is closely related to the value of the fish resource to foreigners. Since the poundage fee does not systematically vary according to willingness to pay by foreign harvesters, the fee for a particular species may be below foreign valuations.

Several studies support this view. Meuriot and Gates (1982) reviewed the literature as well as provided evidence that long-run net benefits to foreigners for walleye pollock, *Theragra chalcogramma*, varied from \$38 to \$117 million per year (1979 dollars). In contrast, poundage fees for walleye pollock for 1981 totaled less than \$21 million (or \$0.76 per pound) based on a poundage fee of \$14 per metric ton plus a 20 percent surcharge[1].

In response to incentives created by the MFCMA, Government policies supportive of U.S. industry expansion appear likely. Indeed, studies have been undertaken by the National Marine Fisheries Service to investigate future development possibilities (e.g., Combs, 1978, 1979).

This paper investigates the economic potential of one such policy: Namely the utilization of up to 15 percent minced fish in the production of hot dogs and other cooked sausage products. Since the U.S. Department of Agriculture (USDA) establishes identity standards for hot dogs, the potential utilization of minced fish in products labeled hot dogs would require USDA approval. Some economic background relevant to the assessment of the utilization of minced fish in hot dogs is presented in this paper. Economic factors investigated include the potential market, costs, competitiveness of minced fish, and potential economic impacts.

The meat-bone separation technology provides an opportunity for domestic utilization of some species which are often too small to fillet (e.g., walleye pollock; silver hake, *Merluccius bilinearis*; and red hake, *Urophycis chuss*). In addition, the meat-bone separation technology enables recovery of high quality fish flesh from larger fish whose fillets have been removed in a traditional manner. These species include most Atlantic cod, *Gadus morhua*; large silver hake, and large walleye pollock.

Research and development has been done on the utilization of the meat-bone separation technology for fish (e.g.,

[1]Fred Olson, Economist, National Marine Fisheries Service, NOAA, Washington, DC 20235. Pers. commun.

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Torry Fish Research Station, 1976). Although technically feasible for a variety of products including cooked sausage, little commercial application has occurred in the United States. In Japan, however, large-scale commercial use of walleye pollock for processing into surimi (a stabilized and frozen fish paste that is made from minced fish) has taken place over the last 10 years.

Potential for Minced Fish

The 1981 TALFF for walleye pollock, Atlantic cod, silver hake, and red hake totaled 1.25 million metric tons (2.76 billion pounds, round or liveweight basis). The TALFF, in accordance with the MFCMA, excludes amounts allocated for domestic fishermen, either for landing in U.S. ports or for at-sea transfer to foreign-flag vessels for processing and transport to foreign countries. The TALFF is consequently smaller than the optimum yield and the maximum sustainable yield, as determined in accord with the MFCMA. Table 1 presents the real and potential catch of the selected species and especially shows the low domestic utilization of walleye pollock. One can clearly see that the potential of these underutilized species is quite large relative to all U.S. landings. In 1981, the TALFF for walleye pollock alone amounted to 45 percent of all U.S. landings.

Assuming yields of 30-50 percent of the liveweight of fish, one obtains a potential minced fish output of 0.8-1.4 billion pounds for the 1981 TALFF (where 2,205 pounds equals 1 metric ton). Production of mince from larger fish now harvested and processed into fillets by U.S. firms would be quite small by comparison although potentially important for the firms involved. Assuming a 10 percent yield for Atlantic cod with fillets removed, and using average landings of 43,575 metric tons from Table 1, around 10 million pounds of Atlantic cod mince would be available.

Nature of the U.S. Sausage Market

The U.S. sausage market, excluding poultry items, amounted to about 5.04 billion pounds in 1981—almost twice the size of the U.S. market for fish. Of this, 2.18 billion pounds were cooked sausage in the form of hot dogs, frankfurters, weiners (1.42 billion pounds), and bologna (0.76 billion pounds) (American Meat Institute, 1982).

The amount of minced fish potentially available from harvesting and processing the TALFF is quite large relative to possible use in the production of franks and other cooked sausage products. The amount of minced fish would clearly be in excess of possible demand in all cooked sausage products, even in the unlikely event that all such sausages contained 15 percent minced fish (requiring approximately 0.33 billion pounds of minced fish). At 5, 10, and 15 percent rates of inclusion in meat franks only (perhaps 0.9 billion pounds excluding beef and poultry franks), use of minced fish flesh would be 45, 90, and 135 million pounds. These magnitudes represent only a fraction of the 0.8-1.4 billion pounds of minced fish potentially available.

Meat franks and weiners are the leading item in the hot dog segment of the sausage market based on special survey data for retail sales (sales for at-home consumption only) conducted by the USDA (Sun, 1982). The breakdown was: Beef, 52 million pounds; poultry, 11 million pounds; and meat, 87 million pounds (average retail sales for 2-month periods during June 1977-November 1980). On a percentage basis, retail sales for the frank and weiner categories of beef, poultry, and meat were 34.7, 7.3, and 58.0 percent, respectively.

The total market for sausage is forecast to continue growing at an annual rate of 1 percent through 1987. However, the weiner and frank segment may continue to decline at a rate of 0.5 percent because of adverse publicity created by the nitrite issue (American Can Co., 1982).

Prices for the various types of hot dogs and sausage ingredients vary significantly. Average retail prices in 1980 were $1.84, $1.11, and $1.58 for beef, poultry, and meat hot dogs, respectively, derived from Sun (1982) and the Consumer Price Index (CPI) for food items (USDL, 1982). At the wholesale level, the most common ingredients in hot dogs vary in price from $0.25 to $0.35 a pound for mechanically deboned chicken to over $1.00 per pound for lean beef. Table 2 presents the current wholesale price structure for common hot dog ingredients.

Costs for Fish Flesh

Current production costs for fish flesh are derived from profit and loss statements found in Combs (1979). This report presents costs for seven underutilized species including two species for consideration in cooked sausage, namely walleye pollock and silver hake. For Atlantic cod and red hake, both Atlantic species, costs similar to those of

Table 1.—Actual and potential catch of selected gadids from resources within U.S. jurisdiction, with comparisons (metric tons, liveweight basis)[1].

Species and area of catch	Optimum yield	TALFF 11/1/80 to 12/31/81	U.S. landings (1977-81 avg.)
Pacific			
Walleye pollock			
Eastern Bering			
Sea & Aleutians	1,100,000	1,055,450	
Gulf of Alaska	196,933	170,640	
Total	1,296,933	1,226,090	1,558
North Atlantic			
Silver hake	55,000	19,400	18,485
Red hake	22,000	5,500	2,420
Atlantic cod	45,570[2]		43,575
Grand total	1,419,503	1,250,990	66,038
Total U.S. landings			
Menhaden			995,007
Other finfish			1,234,031
All finfish & shellfish			2,711,181

[1]Source: USDC (1981a).
[2]Represents 1981 actual harvest.

Table 2.—Prices for common hotdog ingredients, 1982 dollars.

Ingredients	Price
Fresh boneless beef[1]	
50 percent lean trimmings	$0.43
75 percent lean trimmings	0.69
85 percent lean trimmings	1.02
Fresh pork sausage materials[1]	
50 percent lean trimmings	0.43
80 percent lean trimmings	0.80
Chicken[2]	
Mechanically deboned (meat and skin)	0.25
Mechanically deboned (meat only)	0.35

[1]Source: *National Provisioner* (1982:31).
[2]Source: Jim Bacus, Vice President, ABC Research Corporation, 3437 S.W. 24th Ave., Gainesville, FL 32607 Pers. commun.

silver hake are assumed since no detailed cost data were available. Since all values in this paper are reported in 1982 dollars, adjustments to the values in the Combs' report, which are in 1979 dollars, were required. The Consumer Price Index (USDL, 1982) for all items was used to adjust for inflation except where more specialized indices were available, as in the case of fuels, shipping costs, utilities, wages for processing labor, and food[2].

For harvesting and processing walleye pollock, two scenarios are investigated: 1) Harvesting with shore processing and 2) a catcher/processor vessel. In the first scenario, Combs assumed an 85-foot trawler targeting on walleye pollock (Combs, 1979:329) and a shore facility processing a variety of Alaska bottom fish (Combs, 1979:59). For a catcher/processor, a 250-foot vessel targeting on walleye pollock (Combs, 1979:61) is assumed. A variety of outputs from processing operations is assumed by Combs including frozen fillets, frozen fillet blocks, frozen minced blocks, and fish meal. Also when roe-laden fish are available, Combs assumes processors will produce this specialty product. Given the available data, it is not possible to isolate costs for each species and product type. Thus walleye pollock costs represent an average of several product forms. Cooked sausage products would utilize frozen fillets as well as frozen blocks (fillet or mince). Input costs per pound are computed by dividing total costs (variable plus fixed) by total catch. These results appear in Table 3. The calculations are straightforward except for the fact that the skipper and crew are generally paid in shares of catch (40 percent) rather than in wages and salaries. Thus the value of the catch must be determined before skipper and crew expenses can be calculated. Skipper and crew expenses were computed by assuming alternative values of walleye pollock catches of $0.05, $0.10, and $0.15 per pound ex-vessel, live-weight basis. Labor expenses were treated as a variable cost in the harvesting operation. Thus, there are three sets of harvesting variable and total costs, depending on the assumed ex-vessel price of fish. Fixed costs are unaffected by ex-vessel prices.

An alternative approach is to ignore skipper and crew expenses and also net out skipper and crew share (i.e., 40 percent) from total catch. All cost items are thus divided by 60 percent of total catch which reflects the owner's share. These calculations appear in parentheses in Table 3. This approach makes it unnecessary to assume a set of ex-vessel market prices for fish harvested.

The two approaches are equivalent in deriving total cost per unit (i.e., average total cost or ATC) when the price paid the skipper and crew for their share of the catch equals the ATC of the owner's share. For example, in Table 3 when an ex-vessel price of $0.10 per pound is assumed, the two approaches converge and yield ATC of $0.099 and $0.098, respectively. In this case the owner is breaking even, and it makes no appreciable difference how we proceed. However, when the ex-vessel price (P) exceeds ATC and the owner is making a profit (e.g., when $P = \$0.15$), ATC is lower when skipper and crew are netted out of the calculations ($\$0.098 < \$0.119$). Alternatively when the ex-vessel price (P) is less than ATC and the owner is incurring a loss (e.g., when $P = \$0.05$), ATC is higher when skipper and crew share are netted out ($\$0.098 > \$0.079$).

Although the two approaches may not deviate significantly in the calculation of ATC, they differ greatly in their allocations between average variable and average fixed costs. When labor costs are ignored and skipper and crew share is netted out of output, average variable cost is systematically lowered and average fixed cost is increased. This change in allocation between average variable cost and average fixed cost can be important for short-run marginal decisions. Since an operator will continue operating in the short run if price covers average variable cost, anything that affects average variable costs can be important.

All of this may be academic since Table 3 indicates that a catcher/processor mode of production results in lower costs. For a catcher/processor operation, skipper and crew shares are less important and not isolated in the data available. Thus, the ambiguity caused by the two accounting allocation approaches is avoided.

In Table 4, average variable costs and average total costs are converted from an input to an output basis by assuming various yield percentages. These calculations were performed by dividing the numbers in Table 3 by alternative yield percentages. Since only average variable costs and average total costs are relevant for short run and long run decisions respectively, average fixed costs are not reported on an output basis. Table 4 indicates that average costs are extremely sensitive to yield assumptions. The range of average total cost for walleye pollock using the least cost opera-

Table 3.—Production costs per pound of input for walleye pollock, 1982 dollars[1].

Cost type	Mode of production: Shore processing: Harvesting, Ex-vessel price $0.05	$0.10	$0.15	Processing	Total, Ex-vessel price $0.05	$0.10	$0.15	Catcher/processor: Total
Variable	0.045	0.065 [2](0.041)	0.085	0.238	0.283	0.303 (0.279)	0.323	$0.209
Fixed[3]		0.034 (0.057)		0.038		0.072 (0.095)		0.098
Total	0.079	0.099 (0.098)	0.119	0.276	0.335	0.375 (0.374)	0.395	0.307

[1]Outputs from processing operations include frozen fillets and frozen blocks (fillet and mince).
[2]Numbers in parenthesis reflect alternative approach in dealing with skipper and crew share in harvesting, and are independent of ex-vessel prices.
[3]Fixed costs do not depend on ex-vessel price assumptions.

[2]John Vondruska, Economist, National Marine Fisheries Service, NOAA, Washington, DC 20235. Pers. commun.

tion (i.e., a catcher/processor) is $0.61 to $1.02 per pound for an assortment of output including frozen fillets and frozen blocks (fillet and mince). For average variable cost, which is relevant in the short run, the range is $0.42 to $0.70.

Similar calculations were performed for silver hake using Combs' data which assumed an 85-foot otter trawler and a shore facility processing a mixture of defatted fillet blocks and minced blocks (Combs, 1979:206-207). Average costs per pound of input and output for silver hake are found in Tables 5 and 6 respectively. The data available do not allow us to isolate costs by product type. Thus silver hake costs reflect an average of frozen blocks (fillet and mince). Yield assumptions again have a much larger effect on average costs than do ex-vessel price assumptions. From Table 6 we see that average total cost varies from a low of $0.68 per pound of output to a high of $1.27 per pound depending on assumptions. A comparison of walleye pollock and silver hake costs for the shore-based processing model reveals lower harvesting costs but higher processing costs for walleye pollock. These offsetting factors result in very similar total (harvesting plus processing) costs for walleye pollock and silver hake. When a catcher/processor operation is used for walleye pollock, however, average costs are lower for it than for silver hake.

Table 4.—Production costs per pound of output for walleye pollock, 1982 dollars[1].

	Mode of production							
	Harvesting and shore processing						Catcher/processor	
Yield	Variable			Total			Variable	Total
	Ex-vessel price			*Ex-vessel price*				
	$0.05	*$0.10*	*$0.15*	*$0.05*	*$0.10*	*$0.15*		
30 Percent	0.94	1.01 [2](0.93)	1.08	1.18	1.25 (1.25)	1.32	$0.70	$1.02
40 Percent	0.71	0.76 (0.70)	0.81	0.89	0.94 (0.94)	0.99	0.52	0.77
50 Percent	0.57	0.61 (0.56)	0.65	0.71	0.75 (0.75)	0.79	0.42	0.61

[1]Outputs from processing operations include frozen fillets and frozen blocks (fillet and mince).
[2]Numbers in parenthesis reflect an alternative approach in dealing with skipper and crew share in harvesting, and are independent of ex-vessel price.

Table 5.—Production costs per pound of input for silver hake, 1982 dollars[1].

	Production stage						
Cost type	Harvesting			Shore processing	Total		
	Ex-vessel price				*Ex-vessel price*		
	$0.10	*$0.15*	*$0.20*		*$0.10*	*$0.15*	*$0.20*
Variable	0.088	0.108 [2](0.080)	0.128	$0.172	0.260	0.280 (0.252)	0.300
Fixed[3]		0.048 (0.079)		0.034		0.082 (0.113)	
Total	0.136	0.156 (0.159)	0.176	0.206	0.342	0.362 (0.365)	0.382

[1]Outputs from processing operations include frozen blocks (fillet and mince).
[2]Numbers in parenthesis reflect alternative approach in dealing with skipper and crew share in harvesting, and are independent of ex-vessel price.
[3]Fixed costs do not depend on ex-vessel price assumptions.

Table 6.—Production costs per pound of output for silver hake, 1982 dollars[1].

	Harvesting and shore processing					
Yield	Variable			Total		
	Ex-vessel price			*Ex-vessel price*		
	$0.10	*$0.15*	*$0.20*	*$0.10*	*$0.15*	*$0.20*
30 Percent	0.87	0.93 [2](0.84)	1.00	1.14	1.21 (1.22)	1.27
40 Percent	0.65	0.70 (0.63)	0.75	0.86	0.91 (0.91)	0.96
50 Percent	0.52	0.56 (0.50)	0.60	0.68	0.72 (0.73)	0.76

[1]Outputs from processing operations include frozen blocks (fillet and mince).
[2]Numbers in parenthesis reflect alternative approach in dealing with skipper and crew share in harvesting, and are independent of ex-vessel price.

Competitiveness of Minced Fish

Table 7 presents average frozen block prices for selected species along with the range of costs for walleye pollock and silver hake found in Tables 4 and 6. Ex-vessel prices are also included for reference. Under some assumptions, the

Table 7.—Average prices and costs for selected species and form (dollars per pound)[1].

Species and form	Average frozen block price[2] 1981	Average frozen block price[2] 1982[4]	Ex-vessel price 1982	Cost range[3] (1982 $)[2] High	Cost range[3] (1982 $)[2] Low
Walleye pollock			$0.149	$1.02	$0.61
Regular	$0.805	$0.175		(0.70)	(0.42)
Minced	0.400	0.350			
Silver hake	0.743	0.603	0.202	1.27 (1.00)	0.68 (0.50)
Atl. cod			0.329		
Regular	1.092	1.080			
Minced	0.511	0.503			
Red hake			0.169		

[1]Source: USDC (1982b).
[2]Block prices reflect import prices since over 99 percent of U.S. frozen fish blocks have been imported in recent years (USDC, 1982a).
[3]Costs for walleye pollock represent a catcher/processor mode. Numbers in parentheses reflect average variable costs only.
[4]July.

domestic production cost exceeds market prices which reflect import prices since over 99 percent of fish blocks in the United States are imported (USDC, 1982:69). Thus, there is some possibility that the domestic fishing industry may be uncompetitive with foreign fish sources in providing ingredients for cooked sausage products. It should be noted that there is considerable uncertainty in the domestic cost estimates depending on yield factors and market conditions. In addition, producer profits, taxes, and land costs have been excluded from the domestic cost figures. These omissions in the data which tend to underestimate costs may be offset, however, by technological change and economies of scale which could accompany an expansion of the U.S. fish harvesting and processing industries. The concern about domestic industry competitiveness was also expressed by Stokes and Offord (1981) who found that without a 25 percent increase in wholesale fillet and fillet block prices, development of Alaska groundfish was not financially feasible.

Table 8.—Nutritional attributes of fish, beef, pork, poultry, and frankfurter types[1].

	Amount in edible portion of 1 pound of food purchased				
Product	Food energy (k cal)	Protein (g)	Total fat (g)	Cholesterol[2] (mg)	Carbohydrate (g)
Fish					
Walleye pollock					
Fillets	431	92.5	4.1		0.0
Minced (frozen)	330	75.4	3.0		0.0
Atlantic cod (flesh)	354	79.8	1.4		0.0
Silver hake (flesh)	336	74.8	1.8		0.0
Red hake (flesh)	336	74.8	1.8		0.0
Beef, fresh					
Carcass with bone (standard grade)	847	73.0	59.5		0.0
Chuck (no bone) (82% lean)	1,166	84.8	88.9		0.0
Pork, fresh					
Carcass with bone (medium fat class)	1,827	36.3	185.2		0.0
Lean cuts, no bone or skin (medium fat class, 77% lean)	1,397	71.2	121.1		0.0
Chicken fryer, ready to cook					
With bone	382	57.4	15.1		0.0
Without bone (95% lean)	562	84.4	22.2		0.0
Cooked sausage products					
Beef frankfurter	1,462	51.2	133.4	218	10.9
Beef and pork frankfurter	1,454	51.2	132.2	227	11.6
Chicken frankfurter	1,167	58.7	88.3	456	30.8
Cheesefurter (includes beef and pork)	1,483	63.7	131.3	308	6.8
Beef frankfurter with fish (15% frozen minced walleye pollock)	1,365	63.0	114.0		4.5

[1]Sources: USDA (1963) for fish, beef, pork, and poultry data; USDA (1980b) for frankfurter data. Values for minced walleye pollock and beef frankfurters with fish were obtained from ABC Research Corporation (1982).
[2]Data unavailable except for cooked sausage products listed.

Given the cost and price information presented for fish and cooked sausage ingredients, it is apparent that minced fish can be price competitive with beef and pork as a cooked sausage ingredient. Whether the U.S. domestic fish industry, which is best reflected by the production cost calculations rather than frozen block prices, can be price competitive with existing cooked sausage ingredients is not entirely clear. It seems likely that domestically produced fish would not be price competitive with poultry and less-lean meat as an ingredient in frankfurters. Domestically produced minced fish would be price competitive with the higher quality meat ingredients, however.

Since minced fish is high in nutritional quality, it seems more appropriate to fit it into the higher quality end of the cooked sausage market where it appears to be price competitive. Table 8 summarizes some of the relevant nutritional aspects of existing frankfurters and ingredients including fish. The high quality of minced fish as a potential ingredient in frankfurters is clearly demonstrated. For example, if we compare regular walleye pollock blocks with beef (82-85 percent lean) using Tables 2, 7, and 8, we see a comparable protein content, a much lower fat content, and a significantly lower price (e.g., $0.72 vs. $1.02 per pound) for walleye pollock. In Table 9 the price data are related to protein content. One obtains a lower cost for walleye pollock protein ($4.34 per pound) than for beef protein ($5.45 per pound), though not as low as that for chicken meat protein ($1.88 per pound). Thus, there is the potential that cooked sausage formulations could use minced fish as an optional ingredient at up to 15 percent of the final product weight to alter nutritive values and production costs. The lower fat content of minced fish would offer formulators more options in ingredient mixes to achieve specified fat content.

Table 9.—Prices, protein content, and protein cost of selected boneless products[1].

Product	Price per pound	Grams of protein per pound of product (pounds)	Cost per pound of protein
Beef, 82-85% lean	$1.02	84.8 [2](0.187)	$5.45
Pork, 77-85% lean	0.80	71.2 (0.157)	5.10
Chicken meat, 95% lean	0.35	84.4 (0.186)	1.88
Minced walleye pollock, 99% lean	0.61	75.4 (0.166)	3.67
	0.72	75.4 (0.166)	4.34
	1.02	75.4 (0.166)	6.14

[1]Source: Tables 2, 7, 8.
[2]In parentheses are pounds of protein per pound of product.

With a quality oriented marketing strategy, and a competitive price which appears feasible, there is a potential market to utilize part of the TALFF for the species under consideration. If we assume harvesting and mincing of the entire TALFF for walleye pollock, silver hake, and red hake at yields of 30-50 percent, we obtain a new domestic supply of 0.8-1.4 billion pounds. Perhaps

U.S. cooked sausage products might absorb 0.1 billion pounds or approximately 10 percent of the TALFF.

Impacts of Minced Fish

Including up to 15 percent minced fish in cooked sausage products will likely have a small impact on both the U.S. cooked sausage market and domestic fisheries. Some impacts will be felt but we can only speculate as to what they might be. In the analysis by Combs (1979:63-70), it was estimated that after 10 years around 14,000 jobs and annual wages of around $250 million (1979 dollars) would be created if the entire TALFF of walleye pollock were absorbed by the domestic harvesting and processing industries. Inclusion of up to 15 percent minced fish meat in cooked sausage products, by absorbing 10 percent of the TALFF, might thus create on the order of 1,400 jobs in the fish harvesting and processing sectors. If the domestic industry were not price competitive, the job creation potential would diminish.

The impact on employment in the U.S. agriculture sector is difficult to determine since it is unclear whether minced fish would complement or substitute for existing ingredients. If consumers responded favorably to the higher protein and lower fat opportunities afforded by minced fish, an expansion of the cooked sausage market would result. In this case, both the fishing and agriculture sectors would benefit.

To the extent that the cooked sausage market would not expand with the minced fish option, minced fish would displace some pork, beef, and poultry. The net employment impact, if the U.S. fishing industry were to supply most of the minced fish for cooked sausage, would probably be positive. This conclusion is based on a higher labor intensity in the U.S. fishing sector than U.S. agriculture. Although the evidence is scanty, from Combs (1979) we can compute labor's share of total cost in several fishing operations. For walleye pollock (shore processing and a catcher/processor) and silver hake (shore processing only), we compute direct labor cost shares of 0.285, 0.274, and 0.402, respectively (Combs, 1979:59, 61, 207). These labor shares in fishing operations are higher than 0.20 which is labor's share in all agriculture derived from a rough calculation performed for the United States in 1979 (USDA, 1980a:431, 464). Labor's share in agriculture was derived by dividing total expenses in agriculture (including an imputed payment for family workers based on a wage equal to that of hired workers) by the sum of payments to hired workers and imputed payments to family workers. Since the assumptions of no market expansion for cooked sausage and no foreign involvement in supplying minced fish are not likely to be accurate, the impact on U.S. agriculture is very difficult to determine. It's probably safe to say, however, that the impacts on agriculture (positive or negative) will be small.

Conclusion

It appears that allowing the use of minced fish in cooked sausage products has potential from an economic point of view. Although modest in size, a market in which minced fish can successfully compete with existing cooked sausage ingredients seems to exist. Benefits from such a proposal would accrue to the U.S. fishing industry as well as the cooked sausage industry. The former would be provided with the opportunity for wider use of underutilized species through expanded markets while the latter would benefit from more flexibility with respect to cost and nutritional formulations for cooked sausage. If foreign vessels supplied most of the minced fish for cooked sausage, benefits would still accrue to the United States through an increase in value of stocks and opportunities for increases in foreign fees. Negative impacts on traditional suppliers of cooked sausage ingredients appear small.

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