Productivity trends: prepared fish and seafoods industry

Modest output growth and limited technological diffusion contributed to the industry's long-term productivity decline; however, rates of growth in output have increased in recent years along with consumer demand

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Fish and seafood products are enjoying a surge of popularity with consumers in the marketplace. However, the benefits of this rise have yet to be reflected in the long-term productivity growth rates of the prepared fresh or frozen fish and seafoods industry.[1] Productivity, as measured by output per hour, declined at an average annual rate of 0.9 percent per year during the 1972–90 period. Limited technological diffusion and difficulties associated with processing perishable, highly variable, and seasonal products have contributed to productivity declines in this industry.

The productivity indexes represent the change over time in the ratio of the weighted output of a specified composite of products to the employee hours expended on that output. The output and employee hour series that underlie the productivity measures for the prepared fresh or frozen fish and seafoods industry are based on data from the Bureau of the Census. A more complete description of the methodology used to construct these measures is contained in the appendix at the end of this article.

Trends in productivity

The industry's annual average 0.9-percent decline in productivity reflects a 2.3-percent rise in output and a 3.2-percent increase in employee hours. (See table 1.) Although the long-term productivity trend was negative, there was significant year-to-year variation. During the 1972–90 period, annual increases in productivity occurred in 8 years ranging from 0.2 percent to 13.5 percent. Productivity declines were registered in the remaining years, with the single largest decline occurring in 1979, when productivity fell 15.2 percent.

Many of the annual movements in productivity were associated with changes in output. In 7 of the 11 years in which output advanced, there were increases in productivity. Similarly, productivity declined in 6 of the 7 years that output fell. Additional factors that may have adversely affected productivity include: the small and fragmented nature of industry firms and the continued dependence on labor intensive techniques in some areas of production attributable to the complex handling requirements of some products.

Significant advances in productivity occurred, however, despite the long-term decline. Between 1986 and 1988, productivity grew at a rate of 3.9 percent per year, following large increases in demand. In an effort to capitalize on these increases, the industry attempted to boost sales further by responding to issues that might hamper future growth and by identifying opportunities for new growth. With the latest data indicating a continued slowdown in consumption and declines in productivity, these issues may be more relevant than ever.

Output and demand

The 2.3-percent annual increase in output between 1972 and 1990 in the prepared fresh or frozen fish and seafoods industry resulted from years of mod-

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est growth in demand. However, with per capita consumption of fresh and frozen seafood rising some 28 percent since 1982, recent output growth rates have exceeded the industry's long-term average. Nevertheless, continued growth may be jeopardized by concerns about safety, price, supply, and quality.[2]

Public concerns about the safety of consuming fish and other seafoods have recently arisen in response to a barrage of negative publicity about water pollution and the processing standards for seafood products.[3] These concerns may not be unfounded, with some evidence suggesting that fully three-quarters of all consumed seafood is not inspected.[4] To address this issue, industry members have proposed that a comprehensive safety inspection program, administered by a single federal agency, be created to replace the patchwork of programs that currently exists.

The new safety program would be based on a "hazard analysis critical control point" approach. In contrast to the traditional meat and poultry inspection system, in which an inspector continuously checks all facets of an operation, the new system would require monitoring only at those points where contamination is most likely to occur. As envisioned, such a program would require certification of processing plants, increased monitoring of shellfish growing waters, stricter inspection of imports, monitoring of toxic substances, and enforcement of weights and labeling requirements.

In addition to safety concerns, product prices have begun to have an adverse effect on industry sales. While the demand for seafood products has risen considerably, the supply available from traditional sources has remained fairly constant. The resulting shortfall has exerted upward pressure on the price of many products. The industry was initially able to increase sales, even as prices rose. However, these demand-driven price hikes have recently faced significant consumer resistance.

To supplement the supply of fish and seafood from the wild catch, the industry will rely increasingly on aquaculture production. Aquaculture, a process in which fish are raised, fed, and harvested in a regulated environment, results in more predictable harvests and encourages price stability. The controlled growth and clean surroundings associated with aquaculture should also ease concerns about product safety and quality.

The industry has also been actively exploring new markets for its products. In cooperation with trade associations, the industry has participated in advertising campaigns to boost public awareness of and demand for seafood. In conjunction with

Table 1. **Output per employee hour and related indexes for the prepared fresh or frozen fish and seafoods industry, 1972-90**

[1982 = 100]

Output	Output per employee hour			Output	Employee hours		
	All employees	Production workers	Non-production workers		All employees	Production workers	Non-production workers
1972	101.9	101.0	107.5	68.6	67.3	67.9	63.8
1973	93.5	94.8	85.9	65.8	70.4	69.4	76.6
1974	102.7	105.6	88.4	67.7	65.9	64.1	76.6
1975	103.0	103.4	100.0	66.0	64.1	63.8	66.0
1976	97.6	98.2	94.3	66.2	67.8	67.4	70.2
1977	108.9	109.6	104.8	98.1	90.1	89.5	93.6
1978	113.6	113.1	116.1	106.2	93.5	93.9	91.5
1979	96.3	96.6	94.7	94.7	98.3	98.0	100.0
1980	109.3	110.1	104.9	102.7	94.0	93.3	97.9
1981	104.8	104.1	108.3	103.6	98.9	99.5	95.7
1982	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1983	90.0	90.4	87.7	83.9	93.2	92.8	95.7
1984	89.7	92.1	77.9	82.0	91.4	89.0	105.3
1985	88.1	89.5	80.6	86.6	98.3	96.8	107.4
1986	91.4	94.7	76.3	90.9	99.4	96.0	119.1
1987	98.4	99.3	93.6	104.5	106.2	105.2	111.7
1988	98.6	102.0	82.5	107.1	108.6	105.0	129.8
1989	89.8	91.8	79.4	96.3	107.2	104.9	121.3
1990	86.2	87.0	81.9	102.9	119.4	118.4	125.6
	Average annual rates of change[1]						
1972–90	–0.9	–0.8	–1.5	2.3	3.2	3.1	3.8
1986–90	–1.5	–2.1	1.8	3.2	4.7	5.4	1.3

[1]Based on compound rates of change.

retailers, the industry has provided point-of-purchase preparation materials to encourage sales for at-home consumption. The industry has successfully introduced new products including surimi (minced fish that is processed to resemble crab meat, for example) and products with microwave applications which appeal to consumer desires for ease and convenience.

Industry description and structure

The prepared fresh or frozen fish and seafoods industry is comprised of establishments primarily engaged in preparing fresh and raw fish or cooked frozen fish and other seafoods and seafood preparations (such as soups, stews, chowders, fish fillets, fish sticks, fishcakes, crabcakes, and shrimpcakes). Prepared fresh fish are eviscerated or processed by removal of heads, fins, or scales. The industry also includes establishments primarily engaged in the shucking and packing of fresh oysters in nonsealed containers.[5]

Historically, the industry has been fragmented. Although processing establishments vary in size they have generally been small. These trends, however, appear to be changing. Since 1972, the size of establishments has increased from a little more than 48 employees per establishment to nearly 60 employees per establishment in 1987. While establishment size has increased, the number of establishments has recently decreased. There were 518 establishments in the industry in 1972, and 644 establishments in 1987, an increase of 24 percent. This increase, however, masks an important underlying trend. In 1977, the number of establishments increased to 990, but fell to 783 in 1982, and continued to decline to 644 in 1987.

The decline in the number of establishments seems to be at the expense of smaller firms, mirroring trends in the food processing sector as a whole, where there has been fewer but larger plants.[6] In the prepared fresh or frozen fish and seafoods industry, the percentage of establishments with fewer than 20 persons, fell from 51 percent of all establishments in 1972 to 44 percent of all establishments in 1987. Employment and value of shipments at small establishments also declined over the period, so that by 1987, these establishments accounted for 5.5 percent of employment and 6.5 percent of value of shipments. The largest firms, those with more than 100 employees, accounted for 15 percent of all establishments, 62 percent of all employment, and more than 63 percent of industry value of shipments.[7]

Operations and technology

Many firms in the industry are automated, to varying degrees, employing technologies that, in some cases, have existed for years.[8] Most of the equipment has been improved incrementally, and future improvements are expected as existing technologies are linked to computers to aid in such processing areas as inventory, packaging, and labeling. Despite technological advances, productivity has declined, attributable in part, to continued reliance on labor-intensive manual processing methods by some firms.

The transformation of raw fish and seafood into consumer goods is complicated by the large diversity of species and the products which can be derived from them. Each species and product can present processing problems, often requiring modifications to existing equipment. Thus, attempts to fully automate fish processing have met only limited success.

Upon arrival at the processing plant, iced fish are emptied into washers to remove ice and debris. The fish are then loaded onto conveyor belts and sorted. Next, the fish are deheaded, gutted, skinned, and filleted. Traditionally performed manually, these operations have been automated to some extent over the past half century. The advent of automatic fish cutting made high speed production possible with an immense savings of time.[9]

Product characteristics of certain fish, skin texture, size, or delicacy (for example, how well it stands up to the machinery) are factors which may render even the most sophisticated equipment useless. Existing machinery is often modified to avoid labor intensive hand processing. For example, existing filleting machinery, can be modified to process catfish and trout. Gutting machinery can also be modified to process trout. Like standard gutting machinery, the modified machine removes the guts with the gills and gullet and cleans the belly cavity, however, it does so without destroying this delicate fish.[10]

Other processing problems are even more complex, and attempts at modification remain either untested or unsuccessful. The skins of certain fish, for instance, are abrasive enough to damage the blades of processing machinery. There are some species, like squid, for which no suitable machinery is available to remove the skin, and removal by hand is both difficult and impractical.[11]

Unless the processing line is dedicated to a single species, machine modifications can be both frequent and time consuming. Recently available machines can automatically set all filleting tools and the correct timing of individual cuts for many types of fish. A microprocessor is programmed to include the appropriate cuts to the various fish being processed and changes can be made at the touch of a button. This machine is capable of producing 240 fillets per minute.[12]

After filleting, processors often candle the fish, viewing them under light to detect the presence of parasites in the flesh, inspect for leftover skin, or other imperfections. Spoiled fish are discarded. The remaining fillets are then graded, a procedure which can be enhanced by linking digital scale computers, graders, sorters, and bar-code printers. A typical system may have an electronic scale, linked by computer to a timed conveyor belt and a set of automated chutes. As a fish passes the weighing platform on the conveyor, it triggers an electronic eye setting off a timed sequence. At this point, the computer knows how much the fish weighs and which grading chute to send it to. This procedure takes the place of weighing and sorting fish by hand. The machine is capable of processing 120 fillets a minute, up to 65,000 pounds of fish per day, at rates as much as 10 times faster than normal, hand-grading lines.

The grading chute may be linked to automatic packers, allowing frozen fillets and dressed fish to be boxed right at the grading table. In addition to reducing labor time, this process improves product quality, because handling requirements are reduced. A computer then prints appropriate labels, including bar-coded labels that aid in inventory control.[13]

Finally, the processed fresh fish are loaded into iced totes and are ready for shipping. While consumers indicate a preference for fresh seafood products, only 29 percent of seafood sold is consumed fresh. The vast majority, 71 percent, is sold frozen.[14] Using modern freezing technology, processors claim they are able to preserve seafood at the peak of freshness. After freezing and glazing (a process in which fish are coated with a water film in a blast freezer), the fish are bagged, boxed, and placed into frozen storage.

The processing of shrimp involves similar procedures, but presents its own unique problems. The process includes: washing, deheading, inspecting, size grading, packing, weighing, freezing, glazing, refreezing, and storing in a refrigerated warehouse. Modern plants may have water purification systems, flake ice machines, mechanical size-graders, automatic weighing machines and fillers, and a series of belts for conveying the shrimp from one work station to the next. Plate and spiral freezers are often used to freeze the product prior to storage. Deheading, however, generally remains a manual operation.[15] It is the one activity for which no widely available mechanical method exists, although future technological breakthroughs are expected. Additional processing, which may include breading and precooking, can be accomplished using automatic cookers. Other available technologies include in-line-tunnel freezers, filling machines, and peeling and deveining equipment. One of the most recent advances is a peeling and deveining machine which can processs 5,000 shrimp an hour.[16]

In response to the increasing popularity of fish and seafood specialties, processors are using improved equipment to meet demand. Fish and seafood can be processed into balls, sticks, nuggets, cakes and pastes which are by-products of traditional items, such as fillets. Use of the proper equipment, deboning machinery in particular, ensures high quality goods. This equipment debones, eliminates skin and scale, and minces fish.[17] In addition, processors are using microwave technology to temper frozen blocks of fish, easing cutting for fish stick and portion production. The portions are then breaded, precooked, and refrozen for shipping.

Although the use of automated equipment is becoming increasingly commonplace in the fish and seafood processing industry, in some instances, these technologies have been disregarded in favor of manual operations. Many plant owners are discouraged by the cost of equipment, the expense of operating it, the difficulty of obtaining spare parts and service, and the problem of finding personnel capable of running and maintaining it, although quality would be improved and total costs of processing eventually would be lessened. In labor-intensive plants, employees stand along conveyor belts to dehead, slice, and fillet whole fish on the belts, and manually perform those automated operations previously described.

Employment and earnings

Over the 1972–90 period, total employment in the prepared fresh or frozen fish and seafoods industry increased more than 60 percent, from 25,000 in 1972 to 40,500 in 1990, rising at an average annual rate of 2.7 percent. Although the employment trend has generally been upward, declines have occurred. The first declines occurred in the 1974–75 period concomitant with the recession of that time. The next significant and the largest employment decline occurred in 1983, immediately following the 1981–82 recession. With the exception of 1989, employment grew steadily after 1984, reaching a record 40,500 employees in 1990. Total employee hours in this industry have also grown, increasing at a rate of 3.2 percent per year.

The number of production workers in this industry increased from 21,800 in 1972 to 34,200 in 1990, or at an average annual rate of 2.5 percent. The number of nonproduction workers increased from 3,200 in 1972 to 6,300 in 1990—an average annual rate of 3.8 percent. The proportion of production workers to total employment remained fairly stable over the period, decreasing slightly from 87 percent in 1972 to 84 percent in 1990.

Industry employment levels are often affected by the erratic nature of the seafood business cycle. During peak seasons, when large amounts of perishable raw fish have to be processed and shipped quickly, the industry supplements its regular work force with persons having little or no experience. At other times, plants and employees may be idled because of the lack or absence of fish and seafood.

Historically, average hourly earnings of production workers in the prepared fresh or frozen fish and seafoods industry have been below those in all manufacturing, and remain so. According to data from the Bureau of the Census, average hourly earnings in this industry were $2.49 in 1972, compared with $3.95 for all manufacturing. By 1990, industry average hourly earnings rose to $6.79, still significantly lower than the average for all manufacturing which had risen to $11.92 in the same year.

Capital expenditures

Annual capital expenditures in the prepared fresh or frozen fish and seafoods industry increased from $17.8 million in 1972 to $217.1 million in 1990, growing at an average annual rate of 14.9 percent. New capital expenditures per employee grew from $712 to $5,360 during the 1972–90 period. These levels were lower than the average capital expenditure per employee for all manufacturing industries, which rose from $1,335 in 1972 to $5,411 in 1990. The rate of growth in new capital expenditures per employee in the prepared fresh or frozen fish and seafoods industry exceeded the all manufacturing average rate, however, increasing 11.9 percent per year on average, while the rise in the all manufacturing rate was 9.3 percent per year. In the more recent 1981–90 period, capital expenditures per employee grew at an even faster rate of 16.7 percent per year.

Capital investment in the earlier period of this study may have been affected by the emphasis on mergers and acquisitions that was prevalent throughout the entire food processing sector. More recently, investments in factory trawlers (large vessels capable of harvesting and processing fish at sea) diverted capital from onshore processors. Interest in these vessels, however, has waned, as overproduction resulted in declining profitability. The return to onshore investments reflects interest in surimi processing and aquaculture production; both of which should benefit from future capital outlays.[18]

Outlook

Even with the increases in per capita consumption, seafood accounted for only 8.0 percent of all animal proteins consumed in the United States in 1990. Although consumption is expected to increase, there are plans to maximize potential markets. Using promotional and informational materials, the industry hopes to continue to increase per capita consumption, luring consumers away from red meat and poultry products. The development of new products, such as fish sausages, fish hot dogs and other fish snacks, could help generate increased consumption. In addition, the continued evolution of highly processed fish products, such as surimi, is important because these products will serve as essential ingredients in other goods. The development of products for at-home consumption will become increasingly important as the industry tries to gain a larger share of this market. The industry will also seek to secure its position in markets where it has traditionally been strong. For example, the recent addition of catfish fillets to menus in fast food restaurants has increased the industry's position in this market.

However, the immediate concern for product safety remains. Passage of a comprehensive mandatory inspections program will do much to restore public confidence in seafood products. In fact, retailers report that where they have implemented Federal Government-sponsored seafood inspection programs, demand has remained strong. Passage of a safety inspections bill, however, may lead to the closing of processing plants which do not have sufficient capital to upgrade their operations and meet the stricter safety requirements.

In any case, consolidation of firms in the industry is expected to increase. With overall food sales growing by only 1 percent per year, and the cost of introducing new products increasing substantially, companies find it is often cheaper to buy rather than build market share. Sales of seafood are expected to outpace those of other processed foods, making companies within this industry attractive targets for acquisition.

It is hoped that the increase in sales activity will afford seafood processors the opportunity to invest more in capital and equipment. Appropriate investment will allow for further diffusion of existing technologies and implementation of new ones. New technologies envisioned include robots guided by ultrasonic imaging that will remove all bones from raw fish. Other robots will be used to remove shell particles from crab meat, a procedure which is currently performed manually. Increased use of automated technologies will allow for more effective scheduling of labor inputs, and should have a beneficial impact on productivity.

An adequate supply of fish and seafood is necessary for continued industry growth. However, processors have little control over the supply of raw fish and seafood, as these inputs are affected by a wide array of manmade and natural factors. In response, the industry may take a more active role in management of the environment, with a particular focus on the oceans—the source of many of its products. Damage to the ocean by pollutants has caused the sale of products from certain waters to be banned, and in other areas, the damage has been so extensive that entire species have been depleted. Overfishing has also caused some species to become less plentiful. Unfortunately, environmental regulation alone cannot guarantee adequate supply levels, because not all environmental hazards are manmade. Weather patterns can wreak havoc on the ability to harvest the wild catch, while cold snaps and other natural disasters can result in fish kills. Greater use of aquaculture can circumvent many of these problems and provide a more stable supply. Although currently accounting for 11 percent of the Nation's total fish production, aquaculture is limited to a few species. Fortunately, aquacultural technology is applicable to raising other species, making it an increasingly attractive supplement to the ocean catch.[19]

The industry's future seems to hold promise. Transformation into a highly modern, productive industry seems possible. The success of this transformation depends largely, however, on the industry's ability to capitalize on the newfound popularity of its products. Whether the industry can increase its commitment to capital investment, technological improvement, and resource management, as a result of this demand, remains to be seen. □

Footnotes

[1] The prepared fresh or frozen fish and seafoods industry is designated as SIC 2092 in the *Standard Industrial Classification Manual, 1987.*

The average annual rates of change presented in the text are based on compound rates of change. Extensions of the indexes will appear annually in the Bureau of Labor Statistics bulletin, *Productivity for Selected Industries and Government Services.* A technical note describing the methods used to develop the indexes is available from the Office of Productivity and Technology, Division of Industry Productivity and Technology Studies.

[2] See William Frank, "Fishing: New Technology for A New Kind of Decade," *Sea Technology*, January 1990, p. 43; Dave Harvey, "Aquaculture: Meeting Fish and Seafood Demand," *National Food Review*, October/December 1988, p. 10; John Vondruska, W. Steven Otwell, and Roy E. Martin, "Seafood Consumption, Availability, and Quality," *Food Technology*, May 1988, p. 168; "Reeling Them In With Seafood," *Progressive Grocer*, March 1989, pp. 97–105; U.S. Department of Commerce, International Trade Administration, *1989 U.S. Industrial Outlook* (Government Printing Office, 1989), p. 39–5; "NFI Urges Mandatory Inspection," *Seafood Leader*, July/August 1989, p. 16; Carole Sugarman, "The Ongoing Battle of Surf and Turf," *The Washington Post*, Mar. 7, 1990, p. E1; and *1992 U.S. Industrial Outlook* (U.S. Department of Commerce, 1992) p. 32–8.

[3] "Fish Consumption Cools Off," *Seafood Leader*, July/August 1989, p. 33.

[4] "On the Road to Market," *Time*, Mar., 27, 1989, p. 35. See also: "Is Our Fish Fit To Eat?," *Consumer Reports*, Feburary 1992, pp. 103–114.

[5] A more detailed listing of all products produced by the industry is available in the *Standard Industrial Classification Manual 1987.*

[6] *1990 U.S. Industrial Outlook* (U.S. Department of Commerce, 1990), p. 34–1.

[7] Employment, establishment size, and value of shipments data obtained from the *Census of Manufactures* (U.S. Department of Commerce, Bureau of the Census), various issues.

[8] In addition to specific citations, see also: Craig Canine, "Something Fishy at the Seafood Counter," *Eating Well*, September/October 1990, pp. 37–38; and Roy Martin, "Contaminants in Relation to the Quality of Seafoods," *Food Technology.*

[9] "Automatic Cutting and Filleting Sped Frozen Fish Growth," *Quick Frozen Foods International*, July 1985, p. 190.

[10] *Ibid.*, p. 191.

[11] Gudmunder Stefansson, "Enzymes in the Fishing Industry," *Food Technology*, Mar. 1988, p. 64.

[12] "Automatic Cutting and Filleting Sped Frozen Fish Growth," *Quick Frozen Foods International*, July 1985, p. 191.

[13] Kris Freeman, "Giving Good Weight: A Balanced Report on the Latest in Scale Technology," *Seafood Leader*, July/August 1989, p. 182.

[14] Donald J. Short, "What a Difference A Few Years Make; Or, Learning to Get By with Less," *Quick Frozen Foods International*, Jan. 1987, p. 93.

[15] Although shrimp from the wild catch are generally deheaded on board ship, "farmed" shrimp are usually deheaded at the processing plant.

[16] Henry Branstetler, "A Look at Tomorrow's Technology In Processing and Marketing Shrimp," *Quick Frozen Foods International*, April 1987, p. 84.

[17] Shawn E. Lee, "Deboning Fish and Seafood; A Growing Market Factor," *Quick Frozen Foods International*, Jan. 1987, p. 98.; and Roy E. Martin, "Seafood Products, Technology and Research in the U.S.," *Food Technology*, Mar. 1988, p. 60.

[18] See "The Growth and Economic Impact of the Food Processing Industry: A Summary Report," *Food Technology*, May 1988, pp. 97–107; Wyn Francis and Mindy Petrulis, "Food Processing and Beverage Industries: Moving Toward Concentration," *National Food Review*, October/December 1988, pp. 23 and 24; *1989 U.S. Industrial Outlook*, p. 39-5; *1990 U.S. Industrial Outlook*, p. 34-1; and "Frozen Food Firms Figure Prominently In a Number of Major Consolidations," *Quick Frozen Foods International*, October 1987, p. 224. The following are from *Seafood Leader*: "Doughboy Ditches Seafood Lines," July/August 1989, pp. 51 and 52; "ConAgra Expands," November/December 1989, pp. 36–38; and May/June 1989, p. 236.

[19] See Craig Canine, "Something Fishy at the Seafood Counter," *Eating Well*, pp. 35–47; William Frank, "Fishing: New Industry for a New Decade," *Sea Technology*, January

1990, pp. 43 and 44; and "The Food Companies Haven't Finished Eating," *Business Week*, Jan. 9, 1989, p. 70. The following are from *Progressive Grocer*: Richard M. Petreycik, "Freshness is for Volunteers Only," May 1990, pp. 231–232; "Catching the Big Profits," March 1990, p. 82; and "The 1990 Supermarket Sales Manual," July 1990, p. 42. The following are from *The Washington Post*: "Maryland Clams Caught in New Regulations," May 16, 1989, p. B3; "Cold Snap Blamed in Fish Kill," Jan. 31, 1990, p. B3; Dec. 5, 1990, p. E3; and Feb. 14, 1991, p. D2.

APPENDIX: Measurement techniques and limitations

Indexes of output per employee hour measure changes in the relation between the output of an industry and employee hours expended on that output. The indexes of output per employee hour do not measure any specific contributions such as that of labor or capital. Rather, they reflect the joint effect of such factors as changes in technology, capital investment, capacity utilization, plant design and layout, skill and effort of the work force, managerial ability, and labor-management relations. An index of output per employee hour is derived by dividing an index of output by an index of industry employee hours.

Output indexes measure the change in industry output over time. The output index for this industry was developed using a deflated value technique. The deflated value technique removes the price change from the current dollar value of the industry's production. The prepared fresh or frozen fish and seafoods industry consists of three product classes: SIC 20922, prepared fresh fish and seafood, SIC 20923, frozen fish, excluding shellfish, and SIC 20924, frozen shellfish. The value of shipments for each product class, obtained from the Bureau of the Census, are deflated with the following Bureau of Labor Statistics producer price indexes: 20922, fresh packaged fish and other seafood, 20923, frozen packaged fish, excluding shellfish, and 20924, frozen packaged shellfish and other seafood.

The deflated value of shipments indexes are then combined with employee hour weights to derive the industry quantity of shipments index. The industry quantity of shipments index is adjusted for coverage to bring the establishment coded product class shipments data up to the level of total industry shipments.

The annual output index series is adjusted (by linear interpolation) to the index levels of the benchmark output series. This quinquennial benchmark series incorporates more comprehensive, but less frequently collected economic census data.

Employment and employee hour indexes measure the change in the aggregate number of employees or employee hours over a period of time. Employment and employee hours are each considered homogeneous and additive. Hence, changes in the qualitative aspects of employment such as in the skills, efficiency, experience, age, and sex of the persons constituting the aggregate, are not reflected in the indexes. The employee hour data relate to the total time expended by the employees in establishments that are classified in the industry, and include hours spent on the production of primary and secondary products.

The indexes of total employment, production workers, production worker hours, and nonproduction workers developed for this industry are based on data published by the Bureau of the Census. The index of employee hours is derived from (1) production worker hours; (2) number of nonproduction workers; (3) an estimate of average annual hours at work for nonproduction workers. Estimates of nonproduction worker average annual hours were prepared for SIC 20, food and kindred products, and were based on data collected in the BLS biennial surveys of employee compensation in the private nonfarm economy.

Average hours for nonproduction workers are multiplied by the number of nonproduction workers to obtain total nonproduction worker hours. Nonproduction worker hours are added to production worker hours to derive total employee hours.