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Intelligence

## North American markets for fresh tilapia, part 3

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### Automated fillet processing



Although less expensive than hand cutting overall, automated fillet cutting requires economy of scale.

What does it cost to fillet tilapia, and what variables have the greatest influence on the costs of filleting? Tilapia can either be cut by hand or with automated filleting equipment. The decision regarding which system is better for an operation is dictated primarily by the cost of labor and the throughput of fish to be filleted.

The authors calculated the cost per unit weight of fillets for both a hand-cut and an automated facility. In both cases, it was assumed that the fish were owned by the processing facility, and that no cost was ascribed to the whole fish. It was also assumed that costs associated with bookkeeping at the processing facility were handled by the fish production facility, and that no accountant was needed at the processing facility.

The costs associated with **hand cutting fillets** ([https://www.aquaculturealliance.org/advocate/north-american-markets-for-fresh-tilapia-part-2/?\\_hstc=236403678.b6f9a8316cea4f6d04d1134a51874c00.1681713412945.1681713412945.1681713412945.1&\\_hssc=236403678.1.1681713412946&\\_hsf](https://www.aquaculturealliance.org/advocate/north-american-markets-for-fresh-tilapia-part-2/?_hstc=236403678.b6f9a8316cea4f6d04d1134a51874c00.1681713412945.1681713412945.1681713412945.1&_hssc=236403678.1.1681713412946&_hsf)) were covered in this column in the May/June *Global Aquaculture Advocate*. This work was made possible with financial support from the Federal-State Marketing Improvement Program of the Agricultural Marketing Service, U.S. Department of Agriculture.

### Automated cutting facility

The hand-cutting facility described in the previous article was sized to handle approximately 1 million pounds (453 metric tons, MT) of whole tilapia annually, assuming a cutting rate of 1.25 per pound (0.57 kg) whole fish/minute and operation of one, eight-hour shift, five days a week. An automated cutting line, by comparison, processes a much larger quantity of fish. In general, because of the high cost of equipment, an automated facility must be operated more hours than a hand-cut facility in order to distribute equipment costs across a larger volume of finished product.

The processing line considered consisted of the following equipment:

- receive/chill/stun tank
- weigh-in platform
- infeed table to collect and store fish after weigh-in
- bleed/cut machine
- infeed chute from bleed/cut machine to dry bleed system
- dry bleed system
- collection hopper/feed conveyor for collection of product and delivery into the scaler
- drum-scaling machine
- drop-bottom holding hopper
- scale basket
- collection hopper/outfeed conveyor
- heading and filleting system
- intermediate storage table
- skinning machine
- 20-station trim system
- chill/wash system
- fillet takeaway conveyor
- fillet auto feeder
- electronic grading system
- six-station packing system
- vacuum system.

The price for the 21 pieces of equipment was quoted at \$635,500 in January 2011. The floor space occupied by the machinery and work tables for pin bone removal and packing was roughly 120 x 46 ft (36.6 x 14.0 m). Additional space would be required for refrigerating finished product, holding offal, restrooms, break rooms and office space.

## Assumptions

The following assumptions were made for this analysis.

### Equipment costs

Equipment costs ran to \$635,500 for the cutting and packaging line, plus \$20,000 for an ice machine, \$15,000 for two, 10 x 12 ft (3.0 x 3.7 m) freezer rooms and \$10,000 for two cold storage rooms. The total equipment cost was \$680,500.

### Production capacity

The line was operated for two, eight-hour shifts a day, six days a week, 50 weeks a year. The line was designed to handle 40 fish/minute, and it was assumed the tilapia were harvested at a weight of 1.5 pounds (0.68 kg) each. With 40 minutes of downtime for each eight-hour shift, the annual facility capacity was 15,840,000 pounds (7,185 MT) of whole fish. Assuming a yield of 32 percent, this represented 5,068,800 pounds (2,300 MT) of fillets/year.

### Labor requirements

For each eight-hour shift, 20 people were required to remove pin bones from the fillets. An additional seven employees were needed to operate the line, and six employees were required for packing finished product. The machinery was cleaned once a day after the two shifts. Two full-time positions were needed for the daily cleaning. One additional position was for the manager of the entire operation.

### Employee compensation

As in the hand-cut analysis, three labor rate scenarios were considered. For the average pay rate scenario, pin-boning cutters, line employees, cleaners and packers were paid U.S. \$13/hour, and the facility manager received \$40,000/year. For the high rate, hourly employees received \$15/hour, and the manager received \$50,000/year. For the low rate, hourly employees received \$12/hour, and the manager received \$30,000/year. All employees received benefits packages equivalent to 24 percent of their wages.

Additional cost items follow:

- The 7,500-ft<sup>2</sup> (697-m<sup>2</sup>) building cost was assumed to be U.S. \$750,000.
- Useful life was assumed to be 20 years for the building and seven years for the equipment.
- Maintenance costs were assumed to be 5 percent of the yearly equipment purchase costs.
- Financing costs for both building and equipment were 5 percent annually.
- Utility costs were assumed to be \$3,000/month for electric service, \$3,000/month for water and sewer, and \$100/month for telephones.
- Insurance costs were assumed to be \$10,000/year for general liability and \$35,000/year for workmen's compensation.
- Property taxes were noted as \$2,000/year.
- Waste disposal consisting of daily offal pickup by a rendering service cost \$24,000/year.
- As in the hand-cutting analysis, fillets would be packed into boxes in 10-pound (4.54-kg) lots. With a box cost of \$2.50 each, this corresponded to \$106,267/month for boxes.
- Cleaning and miscellaneous supplies were estimated at \$30,000/year.

Table 1 presents the results of the cost analysis.

## Flick, Costs to produce tilapia, Table 1

Cost Item	Monthly Cost (U.S. \$)
68 employees/day @ U.S. \$13/hour	\$176,800
Fringe	\$42,432
Manager (U.S. \$40,000/year)	\$3,333
Fringe on manager	\$800

<b>Total labor + fringe</b>	<b>\$223,365</b>
Packing costs	\$106,256
Cleaning/miscellaneous supplies	\$2,500
<b>Total cost of goods</b>	<b>\$332,121</b>
Loan payment, principal on building	\$3,125
Loan payment, interest on building	\$3,125

Table 1. Costs to produce tilapia fillets using an automated processing line with “medium” labor costs.

## Sensitivity analysis

Repeating the cost analysis, but assuming the high and low labor costs, resulted in fillet production costs of \$0.94/pound (\$2.07/kg) and \$0.82/pound (\$1.81/kg). As was the case with hand cutting, the \$332,121 monthly labor costs represented a much greater expense than the overhead costs of \$32,522/month.

However, the costs for fillets produced with an automated cutting system (U.S. \$0.94/pound with “high” labor costs and \$0.82/pound with “low” labor costs) were not as sensitive to changes in labor costs as those for a hand-cutting line (\$1.78/pound with “high” labor and \$1.32/pound with “low” labor costs) with other variables at baseline conditions.

## Perspectives

Based on this analysis of automated cutting and the analysis on hand cutting presented in [Part 2](https://www.aquaculturealliance.org/advocate/north-american-markets-for-fresh-tilapia-part-2/?hstc=236403678.b6f9a8316cea4f6d04d1134a51874c00.1681713412945.1681713412945.1681713412945.1&_hssc=236403678.1.1681713412946&_hsf) ([https://www.aquaculturealliance.org/advocate/north-american-markets-for-fresh-tilapia-part-2/?hstc=236403678.b6f9a8316cea4f6d04d1134a51874c00.1681713412945.1681713412945.1681713412945.1&\\_hssc=236403678.1.1681713412946&\\_hsf](https://www.aquaculturealliance.org/advocate/north-american-markets-for-fresh-tilapia-part-2/?hstc=236403678.b6f9a8316cea4f6d04d1134a51874c00.1681713412945.1681713412945.1681713412945.1&_hssc=236403678.1.1681713412946&_hsf)),

automated cutting is a significantly less expensive option than hand cutting.

However, it is important to remember that the automated line requires an economy of scale. This analysis assumed that 52,800 pounds (24.00 MT) of fish were processed daily, six days a week, for a total of 15,840,000 pounds/year (7,185.00 MT/year). The analysis of the hand-cutting facility assumed that only 3,200 to 4,800 pounds (1.45 to 2.18 MT) of fish were processed daily, corresponding to 67,000 to 100,000 pounds/year (30.30 to 45.36 MT/year). Also, the initial capital commitment, and hence the financial risk, was much greater in the case of the automated cutting line than the hand-cut line.

With both analyses, it is important to remember that the cost of the fish was not included – only the cost to cut the fish was calculated. Hence, even with automated processing of fillets, it is difficult for aquaculture producers in countries with high labor costs to effectively compete with producers in countries where labor costs are significantly less.

As was discussed in [Part 1](https://www.aquaculturealliance.org/advocate/north-american-markets-for-fresh-tilapia-part-1/?hstc=236403678.b6f9a8316cea4f6d04d1134a51874c00.1681713412945.1681713412945.1681713412945.1&_hssc=236403678.1.1681713412946&_hsf) ([https://www.aquaculturealliance.org/advocate/north-american-markets-for-fresh-tilapia-part-1/?hstc=236403678.b6f9a8316cea4f6d04d1134a51874c00.1681713412945.1681713412945.1681713412945.1&\\_hssc=236403678.1.1681713412946&\\_hsf](https://www.aquaculturealliance.org/advocate/north-american-markets-for-fresh-tilapia-part-1/?hstc=236403678.b6f9a8316cea4f6d04d1134a51874c00.1681713412945.1681713412945.1681713412945.1&_hssc=236403678.1.1681713412946&_hsf)),

to be economically viable, North American tilapia producers facing high production and labor costs must find high-value and value-added markets that are willing to pay a premium price for local, fresh-never-frozen products.

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