



Cutting Techniques in the Fish Industry: A Guide to Precision and Efficiency

* C E Bridgete Princey and Sayan Chakraborty

Fisheries College and Research Institute, Thoothukudi, Tamil Nadu, India

*Corresponding Author's email: ceprincey@gmail.com

Fish serve as a foundational element of worldwide food networks which fulfill continuous rising demand for seafood raw materials and developed products. The primary foundation of this industry consists of scientific and artistic fish cutting practices. Through both time-tested age-old methods alongside technologically upgraded modern practices fish cutting serves to protect product quality while minimizing waste while matching consumer demands. The process of fish cutting began from its early manual practices and progressed through multiple stages until it adopted advanced technological procedures which delivered enhanced operational efficiency and better product quality. Basic fish cutting methods before modern times consisted of worker expertise during which fishmongers delivered fish preparation with basic blades alongside wood boards. The effective artisanal method required extensive training but proved time-consuming when executing various fish cuts which included filleting and deheading and skinning tasks. An examination of standard fish industry cutting methods as well as developments that influence the industry forms the basis of this study.

Safety Practices

- The combination of fish slippiness and dangerous knives makes safety rules essential while processing fish. Fish naturally have slick, moist surfaces, which can easily cause your hands or tools to slip if proper caution is not taken. When this slipperiness is paired with the use of sharp knives—tools capable of causing severe injury—strict safety practices become critical. Understanding how these two risk factors interact helps reduce accidents and ensures a safer working environment during fish preparation.
- General Safety Precautions: All fish-cutting sessions should take place on a stable cutting surface that prevents board movement to minimize cutting-area accidents.
- A secure work surface is the foundation of safe fish processing. A cutting board that shifts or tilts can cause the knife to veer off course unexpectedly, greatly increasing the risk of injury. Using a board with a non-slip base or placing a damp cloth underneath it provides better traction. Ensuring the workstation is clean and organized also reduces distractions and unexpected hazards.
- Knife Safety Requires the Use of Sharp Knives to Reduce Risky Slips and Produce Safer Cutting Results. The advantage of using a sharp blade in fish cutting involves improved control while minimizing the opportunity for harm.
- Contrary to what some may think, a dull knife is more dangerous than a sharp one. A sharp knife requires less force to cut through fish, meaning the user has greater control over the blade's movement. When a blade is dull, more pressure is needed, increasing the likelihood that it will slip and cause accidental cuts. Regularly sharpening knives and maintaining their condition is a key part of safe fish-handling practice.
- A person should minimize blade contact with their fingers throughout blade operation to prevent unintentional cuts.

- Proper hand placement is crucial during cutting tasks. Fingers should be positioned away from the cutting path, ideally curled inward in a “claw grip” to protect the fingertips. This technique not only keeps hands safer but also provides greater stability when holding the fish. Continuous awareness of where your hands are in relation to the blade helps prevent accidental injuries.
- The wound areas become easier to see through proper lighting that provides better safety conditions for cutting operations.
- Adequate lighting is often overlooked but is essential for safe and precise fish processing. Good lighting allows the person cutting to see the contours of the fish clearly, distinguish between bone and flesh, and identify any hazards or abnormalities. Additionally, in the event of an accidental cut, proper lighting helps reveal the wound quickly so appropriate medical attention can be given.

The Basics: Round Fish and Flat Fish

Understanding the anatomy of a fish is the foundation of proper fish cutting. Knowing the structural differences between fish types allows the cutter to choose the most efficient technique, minimize waste, and preserve the quality of the fillets. Broadly, fish anatomy falls into two main categories: round fish and flat fish, each requiring its own approach.

- Round Fish (e.g., salmon, cod, tuna)

Round fish are the most common type encountered in kitchens and processing facilities. They have a cylindrical, torpedo-like shape with bilateral symmetry, meaning both sides of the fish mirror each other.

Cutting Considerations:

- ✓ Because of their rounded shape, filleting round fish typically involves:
- ✓ Making an incision behind the gills to separate the head.
- ✓ Running the knife along the backbone from head to tail, staying as close to the bone as possible to maximize yield.
- ✓ Repeating the motion on the opposite side to remove the second fillet.
- ✓ Trimming rib bones and pin bones that extend into the flesh.

Round fish filleting focuses on contouring along the curved body, requiring smooth, confident strokes.

- Flat Fish (e.g., halibut, flounder)

Flat fish represent a different anatomical structure altogether. Instead of a rounded body, they have a flattened shape that evolved for seabed living. Their most noticeable feature is that both eyes are located on one side, resulting in a top “dark side” and a bottom “white side.”

Key anatomical traits:

- ✓ A wide, flat body composed of four fillets instead of two.
- ✓ A backbone running along the perimeter rather than down the center.
- ✓ Thin, delicately structured flesh.
- ✓ Longer fin bones along the edges.

Cutting Considerations:

Filleting flat fish is more intricate due to the dual-sided structure:

- ✓ The fish is typically laid dark side up.
- ✓ A central incision is made along the top of the fish to expose the backbone.
- ✓ Two fillets are removed from the top side by working outward from the spine.
- ✓ The fish is flipped, and the process is repeated on the white underside.
- ✓ Finer knife control is required to navigate the shallow bone structure without tearing the meat.

Flat fish filleting emphasizes precision and awareness of the fish’s thin layers.

Why Anatomy Matters in Fish Cutting

Recognizing the anatomical category of a fish influences:

- Knife selection — flexible fillet knives for round fish vs. stiffer blades for large flat fish.
- Cutting direction and sequence — central-backbone filleting for round fish; quadrant-style filleting for flat fish.

➤ Yield optimization — minimizing waste by following natural bone structures.
➤ Quality preservation — reducing damage to delicate meat.
By tailoring techniques to the fish's body type, cutters achieve cleaner, more symmetrical fillets with higher efficiency and safety.

Filleting: The Industry Standard

Filleting is the most common cutting technique, producing boneless portions of fish. Skilled workers or automated machinery remove the flesh from the bone with precision. Filleting is done in two main styles:

- Single Filleting: Produces two fillets from round fish or four from flat fish.
- Butterfly Filleting: Popular for smaller species like trout, this technique leaves the fillets attached along the backbone for a visually appealing product.

Modern filleting machines have revolutionized efficiency, processing hundreds of fish per hour while maintaining accuracy.

Steaking: For Larger Species

Steaking involves cutting cross-sections of large fish, such as tuna or swordfish. Each steak includes the backbone, which adds structural integrity and enhances presentation. Steaks are ideal for grilling or baking, making this technique a favorite in retail and restaurant markets.

Portioning: Meeting Consumer Demands

With growing consumer demand for convenience, portioning has become a critical technique. Automated systems cut fillets or steaks into smaller, standardized portions. These are perfect for pre-packaged products found in supermarkets, catering to busy lifestyles and health-conscious consumers.

Pin-Bone Removal: The Precision Step

After filleting, pin-bone removal ensures a boneless product, highly desirable in retail and culinary applications. This process can be done manually or using advanced machinery equipped with X-ray technology to detect and remove even the smallest bones.

Skinning: Aesthetic and Functional

Many recipes and consumer preferences call for skinless fish. **Skinning machines** efficiently remove the skin while preserving the integrity of the fillet. For species like salmon, which is often sold both with and without skin, this step allows flexibility in product offerings.

Deboning Whole Fish: Traditional and Specialized Markets

In traditional markets and specialty cuisines, whole deboned fish is highly prized. Techniques vary from manual precision to using specialized tools, preserving the fish's structure while removing all bones. This skill is especially valued in the preparation of stuffed or decorative dishes.

Sashimi and Sushi Cuts: Art Meets Precision

The sushi and sashimi market demands cuts of extraordinary precision. Fish such as tuna or salmon are carefully sliced to produce visually appealing and uniform pieces. Highly trained chefs or specialized machinery handle this meticulous process, blending artistry with function.

Innovations in Cutting Technology

Modern advanced technology has become the standard for boosting efficiency and sustainability within fish industry operations.

- The technology of water-jet cutting enables operators to slice fish and maintain the original texture while it deals with the flesh delicately through high-pressure water streams.
- Laser Cutting: Emerging technology for ultra-precise portioning.

- Remote Controlled Filleting Systems operate with sensors and Artificial Intelligence technology to maximize output quality while minimizing components loss.

Waste Reduction Strategies

Efficient fish cutting techniques deliver critical value for waste reduction due to their standing as primary goals in this process. Strategies that emphasize accurate handling methods decrease the amount of waste products that emerge during production. Processing by-products from fish production into fishmeal and fish oil along with other useful products serves dual purposes of waste reduction and resource optimization.

Sustainability in Fish Cutting

Industries will prioritize sustainable methods and environmental consequences in their implementation of fish cutting techniques during upcoming years. The increasing fear about overfishing and habitat destruction makes the adoption of innovative cutting methods that support sustainable practices crucial. Scientists develop methods to process fish efficiently together with machinery that controls unwanted catch and protects ocean habitats. The fish industry puts sustainability at the forefront of its operations while cutting methods serve as critical elements. The cutting process should be made efficient to reduce waste output and the derived waste materials from fish skins and bones may lead to fish meal production along with gelatin and other applicable products. The industry focuses on developing processing methods for invasive species which converts disturbing environmental problems into sustainable commercial prospects.

Conclusion: The Art and Science of Fish Cutting

The fish industry continuously develops state-of-the-art technologies that improve cutting procedures starting from conventional knives to robotic systems. Product quality improvements as well as sustainability gains and consumer needs fulfillment emerge from these processing techniques. Technological innovation will make the industry both more technologically advanced and effective in its execution thus maximizing the value of each cutting motion.

References

1. Huss, H.H. (1995). Quality and quality changes in fresh fish. *FAO Fisheries Technical Paper*, 348: 1–195.
2. Sankaran, G. and Gopakumar, K. (2010). Advances in fish processing technologies. *Fishery Technology*, 47(2): 123–132.
3. Sreeram, M.P. and Joseph, J. (2016). Modern filleting techniques for improved yield in fish processing. *Indian Journal of Fisheries*, 63(4): 120–126.
4. Olsen, S.H. and Toppe, J. (2017). Utilization of fish by-products for sustainability and waste reduction. *Aquatic Food Studies*, 2(1): 45–52.
5. Aquilera, J.M. (2018). Precision cutting and portioning in the seafood industry. *Journal of Food Engineering*, 230(1): 50–59.
6. Kumari, R. and Radhakrishnan, K. (2019). Safety protocols in fish handling and processing. *Journal of Marine Sciences*, 8(2): 88–93.
7. Takashi, Y. (2020). Traditional and modern techniques in filleting of round and flat fish. *Asian Fisheries Review*, 12(3): 101–109.
8. López, D. and Martínez, R. (2021). Technological innovations in fish-cutting systems. *International Journal of Food Technology*, 15(4): 210–218.
9. Wang, Z. and Chen, L. (2022). Application of water-jet and laser cutting in seafood processing. *Journal of Food Processing Innovations*, 9(1): 33–41.
10. Perera, N. and Dissanayake, D. (2023). Sustainable fish processing: reducing waste through advanced cutting methods. *Fisheries Sustainability Review*, 5(2): 67–76.