



From Ocean Catch to Consumer Trust: Digital Ledger Systems in Seafood Supply Chains

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DESCRIPTION

Seafood moves through a long and often complex network before reaching a plate, passing from fishing vessels or aquaculture farms to processors, distributors, retailers, and finally consumers. Each stage introduces opportunities for mislabelling, contamination, or loss of information about origin and handling. Concerns about illegal fishing, species substitution, and unsustainable practices have increased demand for transparent tracking methods that can verify the history of seafood products. Digital ledger systems based on blockchain technology have emerged as a solution to record and share information in a way that is secure, traceable, and resistant to unauthorized changes.

Blockchain functions as a distributed database where records are stored in linked blocks. Each entry is time-stamped and connected to previous entries, creating a continuous chain of information. Once data is recorded and validated by participants in the network, it becomes very difficult to alter without consensus from the system. This feature supports accountability across the seafood supply chain by ensuring that details about harvesting, processing, and transport remain consistent and verifiable.

In seafood traceability, blockchain systems capture data at critical points. For wild-caught fish, information such as vessel identification, fishing location, date of capture, and species type can be entered at the time of landing. In aquaculture, records may include farm location, feed type, health management practices, and harvest conditions. As the product moves through processing and distribution, additional data such as storage temperature, packaging, and shipment details are added to the ledger. By the time the product reaches the consumer, a comprehensive digital history is available.

One of the main advantages of this system is the reduction of fraud. Mislabelling of seafood species is a widespread issue, often driven by economic incentives. Lower-value fish may be sold under the name of more expensive species, misleading buyers

and distorting market dynamics. Blockchain-based traceability helps prevent this by linking each product to its verified origin. Retailers and consumers can access this information through QR codes or digital platforms, allowing them to confirm the authenticity of what they are purchasing.

Food safety is another area where blockchain contributes significantly. If contamination occurs, rapid identification of the source is essential to limit harm. Traditional record-keeping methods can be slow and fragmented, delaying response efforts. With blockchain, investigators can trace the path of a product quickly by following its digital record. This allows targeted recalls rather than broad removals, reducing waste and economic loss while protecting public health.

Sustainability concerns also benefit from improved traceability. Overfishing and illegal, unreported, and unregulated fishing practices threaten marine ecosystems. By recording catch data and verifying compliance with regulations, blockchain systems support responsible sourcing. Certification bodies and regulatory agencies can use these records to confirm that seafood products meet environmental and ethical standards. Consumers who prioritize sustainable choices gain access to reliable information that supports informed decisions.

Despite these advantages, implementing blockchain in seafood supply chains presents several challenges. One major issue is data accuracy at the point of entry. While blockchain can secure information once it is recorded, it cannot guarantee that the initial data is correct. If false or incomplete information is entered, it will remain part of the permanent record. This highlights the importance of reliable data collection methods, including the use of sensors, digital tagging, and standardized reporting practices.

CONCLUSION

As global seafood trade grows, the need for reliable traceability systems becomes more pressing. Blockchain offers a structured approach to recording and sharing information across complex

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supply chains, supporting accountability, safety, and sustainability. While challenges remain in implementation and standardization, ongoing developments indicate a steady movement toward more transparent seafood markets. By

improving the visibility of each step from harvest to consumption, blockchain-based systems contribute to greater confidence among producers, regulators, and consumers alike.