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Blockchain Technology for Ensuring Data Integrity in Fish Taxonomy and Specimen Records

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Abstract

Adopting blockchain technology to assure data integrity in fish taxonomy and specimen records is a viable approach for boosting the dependability and openness of scientific research, conservation, and fisheries management activities. The research determines that blockchain technology related to the data integrity in fish taxonomy also that specimen records. This ground-breaking method uses the blockchain's decentralized, immutable ledger system to overcome major issues with field data management. Blockchain technology protects data reliability by securely storing taxonomic changes and specimen records. Research based on primary data analysis related to them. The inability to update or remove data from the blockchain once entered lowers the possibility of mistakes, fraud, or unauthorized alterations. Ensuring data integrity has become essential in a time when data is used to drive decision-making in many different industries. Traditional data management systems are prone to problems, including fraud, data loss, and manipulation. The development of blockchain technology has made it possible to overcome these issues and ensure data integrity. Additionally, the auditing and compliance procedures are made simpler and ensure compliance with regulatory standards due to the traceability of all changes and access to records. While implementing blockchain has drawbacks—scalability and energy use issues—the potential rewards outweigh these drawbacks by a wide margin. By enhancing data integrity in fish taxonomy and specimen records, blockchain technology presents a viable foundation for more successful scientific research, conservation activities, and fisheries management. To take advantage of these benefits, participants in this industry are urged to investigate how blockchain may be incorporated into their current data management procedures.

Keywords: Blockchain Technology (BCT), Fish taxonomy (FT), Management procedures (MP)

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Introduction

In the modern world, data recording is considered a key asset. It is tactical towards the functionality of different fields, from commerce, finance, and the education sector to health, medical, and academic records collection. With the growing dependence of humans on computer-related technology, maintaining data integrity and stability has become crucial. Speaking of academic and research fields, fish database management has been used to keep the taxonomic records and biodiversity patterns of different fish species, digitalized in one safe place. But with this aid comes the vulnerability of such systems to cyber-attacks that alter the stored data's availability, integrity, and confidentiality. The crucial data is continuously subjected to different cyber outbreaks that alter the data's confidentiality and allow malicious operations to drive. Duch malicious operations include deleting data, making unknown entries, fluctuating the previously quoted data, and misediting particular data sections. Therefore, the only motive behind storing fish data in databases was to secure the taxonomy and look for environmental drivers, which can easily be compromised.

Given the cyber issues, a new data storage technology was introduced in 2008, named Blockchain Technology. This technology, as the name refers, is concerned with replicating a database and scattering it over numerous nodes that are in turn related to diversified parties. It provides a safe database based on secured

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blockchain technology for computer surroundings related to cloud storage. Initially, it was used as an archive for Bitcoin transactions, but later on, it opted for data storage related to many fields. The advantages of blockchain technology involve the providence of agreement to the uninterrupted distribution of data, tenacity, and data validation. Because of these reasons, blockchain technology is being applied specifically to store fish taxonomic data to deduce conservation strategies for the endangered and most susceptible fish assemblages (Dhinakaran & Prathap, 2022).

The applications of blockchain technology in storing data can be numerous if used correctly. First, the fish species data would have integrity and validation for authentication. Because data integrity issues are common all over the world as the data owners don't control the location of storage which makes the data open to foreign misuse. The data integrity allows the fish-related data to be kept according to their evolving species. Moreover, the advantage of this storage is that it relieves the burden of data storage and maintenance locally.

Similarly, another advantage of blockchain technology is that it violates data replication. This feature allows the fish species databases to be piracy-free. It allows the diversified explanation of fish taxonomy and records of specimens, imitation-free. Moreover, the fish data stored over databases remains non-repudiable, confirming the authenticity of the data. Other than that, the fish database can be provided easily for lifelong access. This reduces the chances of data forging and makes it easy for fisheries experts to use the validated data from centuries ago to make development changes through fish assemblages. Data is the lifeblood of businesses, governments, and people in today's digital world. It supports several processes, stimulates creativity, and informs decision-making. However, data reliability is frequently jeopardized because of flaws in conventional data management methods. This is where blockchain technology comes into play, providing a ground-breaking method to guarantee data integrity. A distributed ledger that tracks transactions over a network of computers is the foundation of a blockchain. These transactions are organized into blocks and connected in a timeline. The following characteristics of blockchain technology make it perfect for assuring data integrity: Blockchain runs on a decentralized network of nodes instead of conventional centralized databases. There is no single point of failure because every node possesses a copy of the full blockchain. Data that has been uploaded to the blockchain cannot be changed or removed without network agreement. This immutability guarantees that data is unaltered and impenetrable. The blockchain is a transparent system that allows all authorized users to observe the whole history of transactions. This transparency increases users' confidence. Advanced cryptography is used by blockchain to safeguard data. Consensus technology verifies transactions and adds them to the blockchain, making it very challenging for hackers to change the data. These contracts automatically carry out their conditions since they are written in code. These agreements guarantee that procedures are carried out as planned when automating them.

Another important application that blockchain technology provides is to control the trading of environmentally endangered fish species. Due to urbanization, fish is becoming the most used source of protein. This high demand for fish is making the trade of illegal and vanishing fish species. But if the fish database is linked with blockchain technology, this depraved act can be controlled. Because, if fish taxonomic data has been put over blockchain databases, it ensures its legitimacy. With this legitimacy, specific fish species with a low chance of vanishing and facing lethal effects can be selected, which can be later approved for trading and consumption.

Moreover, the authentic taxonomic history and specimen data stored over blockchain make the fisheries expert capable of selecting a fish group with high protein providence and can reproduce exponentially to meet the growing demands of the increasing human population. The world's fish sector is quickly growing, and during the previous 50 years, per capita seafood consumption has doubled. Today, aquaculture, often known as fish farming, provides a livelihood for more than one in ten people. Wild-caught and farmed seafood comprise 15%

of the world's protein consumption and around 2% of all calories. According to the most current measurement of worldwide aquaculture output, the overall yearly volume 2015 remained at 138 Mt, with wild capture landings making up 60% and aquaculture production responsible for 40%. The vast wild potential catch has already drawn worldwide interest, and the ramifications in the interest of marine ecology have introduced new difficulties for the whole seafood industry. Taking into account the following factors, this ecosystem is expanding too quickly for it to continue as it is: According to the research, the amount of marine life on Earth has decreased by 50 percent over the last 40 years, since 1970. This means that the ocean's productivity is declining and a greater demand for fish than the ocean can sustainably provide. Another report claims that since 1950, nearly 90% of the most frequently caught fish have gone extinct, putting us in grave danger of beginning a period of marine extinction of species unheard throughout human history.

These issues may be resolved using blockchain technology, which unites all supply chain participants on a single platform and offers a workable solution ensuring product traceability. A few organizations have already successfully reaped the rewards of blockchain technology. Because blockchain cannot be altered, it may efficiently provide security, traceability, and reliability to any system. While existing fishing industry systems provide product information continuity across the preliminary processing and additional processing phases, the systems are insufficient to monitor fish data throughout the fish processing phase when morphological changes occur. These approaches also rely on equipment based on RFID and QR codes to track and maintain information on the movement of goods. While combining blockchain with IoT devices enables greater data integrity and administration, the traceability management of the aquaculture supply chain is not yet effectively managed. These supply chain gaps may allow species adulteration and fabrication during fish processing due to removing tags containing RFID and quick response codes. As a result, dishonest people may use this chance to conduct food fraud by substituting low-value species for high-value ones. Therefore, once a fish species' skin is removed, it is easy for con artists to alter the fish goods.

Fish farming is the practice of rearing fish for commercial purposes in enclosures or tanks, such as ponds. In greenhouse-style fish farms, large plastic tanks with a diameter of 4 m and 0.75 m of sea depth are commonly employed. A tank system improves security significantly. since Concentration of production in a small location rather than a big cage system, such as fish ponds installed in lakes. Even though it still needs skilled fish farmers to manage the fish farm's resources, this would drive up labor expenses. Farmers must also deal with concerns such as climate change, a limited water supply, and a decreasing supply of fossil fuels. Precision farming, a farm manager strategy that employs indicators, information, and network connections to customize the farming system to the unique conditions of each field, is one way that the Internet of Things is transforming how farmers operate.

To ensure the integrity of farm data, this research more specifically suggests DLT for storage. The distributed ledger fully documents all activities on the fish farm. It is inextricably related to the information obtained by the farm sensor. Furthermore, smart contracts are used to automate data related to agriculture processing, including outlier screening before creating ledger entries. Smart contracts can initiate and carry out certain activities according to the information kept on the blockchain. Access control rules are developed to allow particular parties to access network resources or perform actions within the corporate network. Since it improves transaction security and maintains data openness as the backbone, a permissioned blockchain network is implemented. In our earlier work, we constructed on top of the required proof-of-concept architecture for testing the entire system functionalities utilizing the fish farm system and the Hyperledger Fabric software (Feng, Wang, Chen, & Zhang, 2020).

A vital part of a blockchain-based system that allows stakeholders to track the fish product is traceability. Tracing enables stakeholders to track the biological and physical attributes of a product in addition to its

surroundings, including humidity, temperature, and biological characteristics, as the item in question moves through the production, marketing, and shipping stages until it reaches the end consumer. Because stakeholders are still struggling to understand the benefits of a blockchain for the fish sector and quantify its worth, they are unaware of its ability to improve the trackability and accountability of seafood and fish-based products. As a result, blockchain usage, logistics, and management remain minimal.

Smart farming, on the other hand, needs portable, Security and privacy are spread out and scalable. To deal with these problems and difficulties, some research has been geared toward new paradigms centered around distributed ledger technology, also known as blockchain, due to its ability to reduce a single point of failure and improve data transparency and rigidity, which has the potential to transform the present-day economy's structure and governance. Many possible digital ledger farm solutions are emerging, according to Agfunder News. This includes companies that developed concepts like smart agriculture and food tracking via supply chain electronic ledgers. Filament uses blockchain technology to broadcast tamper-resistant weather data, SMA alerts, equipment protocol, and GPS position data on the farm. removes a single point of failure while increasing data openness and immutability, potentially altering present economic organization and management. SkuChain's technology emphasizes direct interactions while increasing trust and understanding of the flow of commodities. The majority of blockchain discussions center on retail transactions and monitoring agricultural inputs and outputs, notably food safety monitoring. Agricultural data from sources such as soil sensors, weather satellites, unmanned aerial vehicles, and agricultural equipment kept in a distributed store using blockchain allows us to build trust and ensure long-term agricultural growth. Furthermore, it improves decision-making and automates it at the individual farmer and community levels by collecting and analyzing data (Patro, Jayaraman, Salah, & Yaqoob, 2022).

In the same way, the aquaculture industry can meet the required demands by ensuring the data integrity of fish assemblages. The data related to aquaculture can be stored in blockchain databases to make a validated guide for the industry's development. For example, the data related to fish i.e., culture temperature, age, harvest conditions, and feeding ratio can be stored and reached out effectively. This type of data storage provides better visibility to the producers so that they can meet the demands of the market and as well as make fish aquaculture efficient for consumer demands.

Moreover, the fish groups can be saved from the damage that occurs during fish storage, processing, and transport. Suppose the data related to these requirements is saved over a block technology database. In that case, the authorized persons can easily access the fish transportation and can deal with any kind of contamination occurring during transport, on the spot. Endangered species need to be conserved, but the importance of keeping records of extinct or ancient species can also not be denied. To save this data without any doubt of it getting replaced or vanishing, blockchain technology serves the cause. The fish specimens stored for academic and research purposes can be easily managed by scattering the data over blocks. This scattering will allow researchers from all over the world to access the specimen's exact location and storage conditions. Using this data, fisheries expert can easily manage the conditions for specimen storage in their specific regions without undergoing unwanted and useless experiments.

Besides these returns, block technology can open doors of currently fish-related data to future researchers and agencies, with which they can make required deductions, without worrying about authentication. In short, blockchain can be termed as a fish database management method for more enhanced, secured information that not only ensures the integrity of that data but also ensures the easiness of learning procedures for future fisheries students, allowing them to have a convenient, customized, improved and transparent experience of acquiring knowledge and holding onto the data that has been given through the verified credentials.

Applications:

Blockchain technology has applications in a variety of industries, and each of them shows promise for ensuring data integrity:

1.**Financial Services:** Bitcoin and other cryptocurrencies are well-known blockchain applications. It provides a tamper-proof ledger and does away with the need for middlemen to maintain the integrity of financial transactions.

2.**Supply Chain Management:** Blockchain may be used in supply chains to track the origin of items, assuring product authenticity and lowering fraud. It may be used, for instance, to confirm the legitimacy of organic food items.

3.**Healthcare:** Blockchain technology can protect patient information in the healthcare sector and guarantee the accuracy and immutability of medical records. Additionally, it helps with drug traceability, lowering the possibility of illegal narcotics being sold.

4.**Voting Systems:** By offering a safe and transparent platform for elections, blockchain has the potential to revolutionize voting systems. It guarantees accurate vote counting and guards against fraud.

5.**Intellectual property:** Blockchain may be used by authors, artists, and other creators to timestamp their work and show when it was created. Plagiarism is avoided and intellectual property rights are protected.

6.**Real estate:** Blockchain can simplify real estate transactions, lower fraud, and guarantee that property records are accurate and unchangeable.

7.**Energy Sector:** Blockchain in the energy trading industry may ensure the provenance of energy supplies and the integrity of transactions, boosting sustainability.

Literature review:

Researchers explain that the traditional food production chains were complex and difficult to understand. modern technology has eased the process of understanding of complex food chain.the more a food chain becomes complex, the more its food chain transparency value increases. efficient management strategies improve the food chain cycle associated with fish species (Astill et al., 2019).studies claim that most Fishbourne diseases cause mortality around the globe. The aquatic ecosystem contamination results in the disturbance of aquatic food chain. the data about fish contamination helps develop strategies to stop the prevalence of Fishbourne diseases(Bedane, Agga, & Gutema, 2022).studies explain that different aquaculture has different food supply chains that determine their importance in aquatic ecosystems. The use of blockchain technology provides application in understanding the seafood chain. blockchain technology determines the relationship between fisheries practices and aquaculture(Blaha & Katafono, 2020).studies suggest that data about the seafood-related food chain is confidential data. This data is placed in a safe, well-encrypted location through the two-fish algorithmic model. This algorithm ensures that the data related to aquatic food chain is safe and secure. Protecting databases related to the food supply chain is essential for managing the aquatic ecosystem functioning. Studies suggest that blockchain technology is characterized by storing data through algorithms. blockchain technology specializes in transforming the food chain supply mechanism into aquatic mechanisms. the research about the food chain associated with several aquatic ecosystems is done using blockchain technology(Dutta, Choi, Somani, & Butala, 2020).studies explain that the shellfish quality evaluation is made using the information technology-based monitoring system during the cold season. The multi-sensors based on blockchain technology are used in various aquatic ecosystems to determine capturing parameters.The SVM

algorithmic model and a multisensory monitoring system are used to improve the transparency factor associated with frozen shellfish. The principles of blockchain technology, its uses in numerous fields, and its significance in preserving data integrity are all covered in this article. Researchers, scientists, and organizations involved in taxonomy and specimen management may quickly access and verify data due to the blockchain ledger's transparency, which promotes trust. Smart contracts may automate taxonomy updating procedures, speeding data administration and lowering administrative burden. Blockchain technology's strong cryptography and consensus procedures offer improved data security, protecting sensitive data from online attacks. studies explain that fish wireless transportation is done to save fresh water from pollution.the transportation of fish through a waterless procedure is a novel and workable, cost-effective strategy. The efficient monitoring system helps gather the most accurate and authentic data about aquatic fisheries. The wireless monitoring system works on the blockchain technology principle that advances the motoring system(Feng et al., 2022).studies highlight that IoT-based monitoring systems are used for managing food-related supply chains. the performance of the supply chain improves by fusing the Blackchin technology with IoT networking systems (George & Jayashree, 2022).studies reveal that internet technology use has advanced the field of fish farming. smart fishing techniques are possible using blockchain technology. also, the data obtained through blockchain technology about the smart fishing technique helps in understating all the activities related to the fish farming field(Hang, Ullah, & Kim, 2020).studies explain that the traditional food supply chain associated with aquatic ecosystems disturbs the sustainable fish industry developmental process. For building trustworthy and improved fish industries, blockchain technology and IoT are used in aquatic fields. Studies explain that development in shrimp production has been seen in the last few years because of the use of advanced technology in the production of shrimps. but despite shrimp production in bulk, its export has been reduced. the reduction in shrimp export in Bangladesh is mostly because of the lack of transparency associated with shrimp production industries. for developing effective ways to keep a record of the shrimp supply chain safe the use of blockchain chain technology is employed in shrimp supply management industries(Khan, Hossain, Shahaab, & Khan, 2022).moreover , blockchain technology for effective data storing and management holds critical value.the central authority is not required to use blockchain technology thereby it is one of the most widely used technology for producing authentic databases. Studies reveal to ensure good public health, it is very important to know about the origin of certain products. the awareness about the origin of food products helps educate people about the quality of different food products. tracing the fish's food supply chain process through blockchain technology-based monitoring systems is essential. The traceability information maintained through blockchain technology is accurate and error-free (Oliveira et al., 2021).studies predict that using blockchain technology in food-related industries provides great applications in traceability systems. Blockchain food traceability system uses various methodologies to provide potential applications and benefits to aquatic food industries(Olsen, Borit, & Syed, 2019) Moreover, the supply chain related to the fishery ecosystem is efficiently managed through traceability management strategies. These strategies manage the aquatic food supply chain. The negligence in the product traceability causes food-related fraud.by monitoring the process of the food supply chain, the stakeholders can identify the origin of food fraud processes. studies highlight that traceability system contributes to improving the food supply management process. The real-time visibility feature provided by using blockchain technology-based traceability systems improves the transparency of food chains. The sustainability of seafood-based industries depends mainly on using blockchain technology, as it collects all the data regarding the seafood chains.studies claim that various food industries redesign their food supply chains to achieve sustainability goals.by digitalizing the blockchain technology helps in improving the food industries working mechanisms .the food security factor associated to any food chain is maintained using the modernized blockchain technology(Tsolakis, Niedenzu, Simonetto, Dora, & Kumar, 2021).studies explain that lack of high quality fish

tracking system results in poor assessment of fish quality.by using the SFM model, an advanced blockchain tracking system is developed. Modernized blockchain technology-based tracking systems are secure as they provide authentic data(Wang et al., 2021).scholars explain that block chain technology helps get the foods safety control over the aquatic food supply chain .food safety is associated with improving the economic value of any country(Xu, Li, Zeng, Cao, & Jiang, 2022).furthermore , marine aquaculture-based management strategies improve the ecological sustainability factor associated with aquaculture. Using blockchain technology for fisheries modernization improves the overall efficiency of the aquatic food supply chain.

Especially in scientific research, conservation efforts, and fisheries management, using blockchain technology to maintain data integrity in fish taxonomy and specimen records might be a viable strategy. Here are some ways that blockchain can be used in this industry:

1.Immutable Data Records: A blockchain is simply a decentralized ledger that keeps tamper-proof, time-stamped records of all transactions. A chronological and unchangeable history of transactions is created by the chain's reference to the preceding block in each entry (or block) of the chain. Each entry in the context of fish taxonomy and specimen records might be a record of a particular fish specimen or a change in taxonomic categorization.

2.Data Verification: Data associated with fish taxonomy and specimen records put to the blockchain cannot be changed or removed without the network's participants' consent. Ensuring data integrity and preventing unauthorised changes lowers the possibility of data manipulation, mistakes, or fraud.

3.Timestamped data can be used to construct a precise timeframe for taxonomy changes or specimen records since each block in the blockchain has a timestamp attached. This is essential for scientific study since it preserves a record of previous taxonomic changes and specimen observations.

4.Blockchain's decentralized network of nodes minimizes the possibility of a single point of failure or data loss. The network has many copies of the blockchain, which makes it resistant to data loss or corruption.

5.Access Control: Cryptographic keys can be used to restrict access to the blockchain. Specific areas of the blockchain can be made accessible to researchers, scientists, and appropriate authorities, guaranteeing that only authorized persons can alter or validate entries.

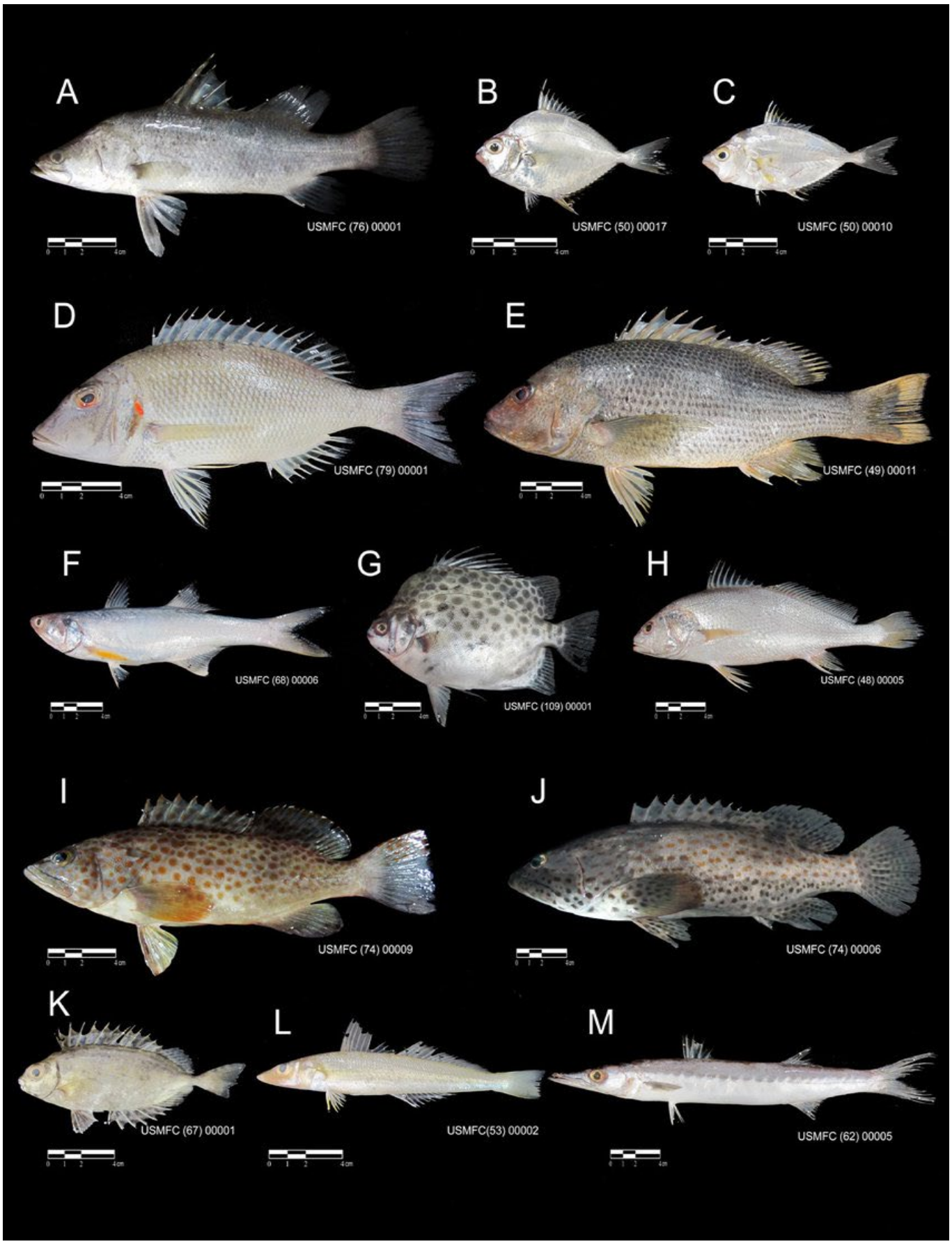
6.Blockchain is interoperable with the databases and information systems used for fish taxonomy and specimen management. This makes it possible for smooth data transfer and old system compatibility.

7.Smart Contracts: These contracts automatically carry out their conditions since they are written in code. Smart contracts might be applied to fish taxonomy to automate updates and approvals for taxonomy revisions, guaranteeing that modifications are conducted in line with predetermined standards.

8.Data Transparency: The ability for all authorized parties to access the complete transaction history provided by blockchain technology fosters data transparency. Due to this transparency, researchers and organizations working in fish taxonomy and specimen records may feel more confident.

9.Auditing and Compliance: Because all modifications and access to data are traceable, blockchain records can simplify auditing and compliance procedures. This is especially helpful in ensuring conservation and research projects follow legal standards.

10.Blockchain uses cutting-edge encryption technology and consensus procedures to safeguard data. This aids in shielding delicate data about specimens and fish taxonomy from online dangers.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Advantages:

The advantages listed below can be attained by utilizing blockchain technology:

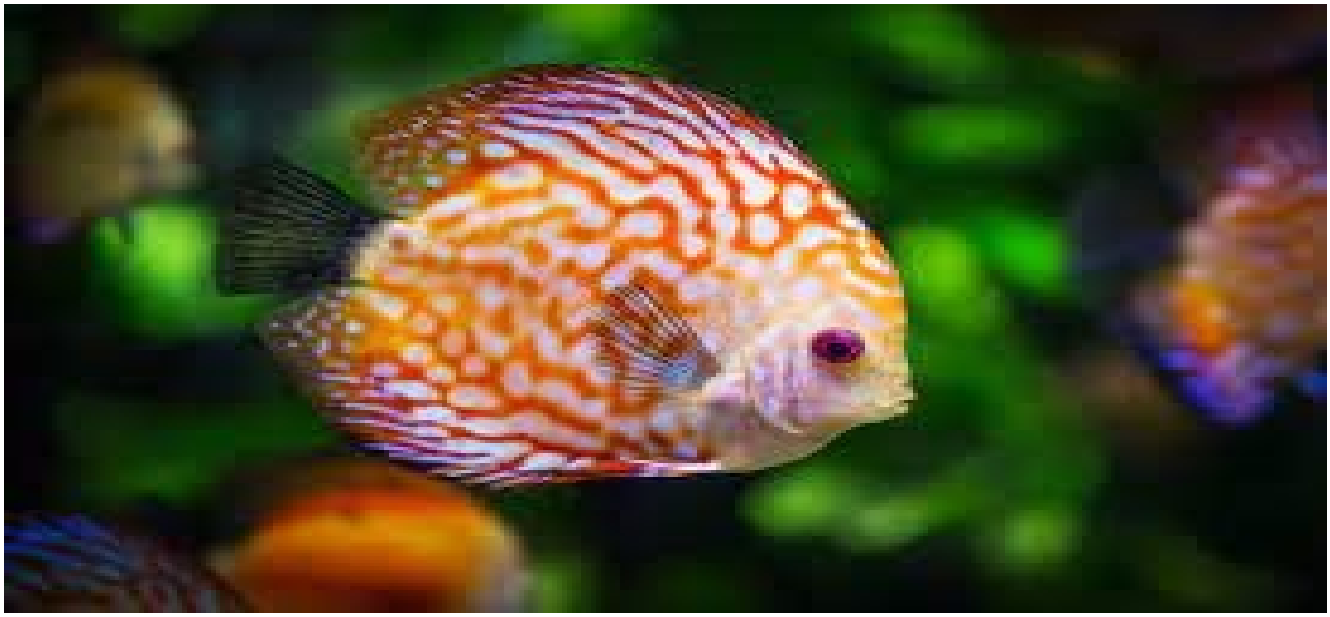
1.Data Reliability: Blockchain ensures that data cannot be changed or erased without consensus after being recorded. Eliminating the possibility of mistakes, fraud, or unauthorized alterations ensures the accuracy of fish taxonomy and specimen data.

2.Transparency: Blockchain's transparent ledger promotes confidence among academics, scientists, and organizations engaged in taxonomy and specimen management by making it simple for authorized parties to access and verify data.

3.Efficiency: Taxonomy changes and approval procedures may be automated by smart contracts, which simplifies data maintenance and lowers administrative costs.

4.Security: Blockchains' encryption and consensus techniques offer strong data security, shielding sensitive data from online dangers.

5.Compliance and Auditing: The ability to track all changes and access documents simplifies compliance and auditing procedures, ensuring that conservation and research initiatives comply with legal requirements.



Challenges:

Although blockchain technology has great potential for assuring data integrity, there are difficulties and factors to take into account:

1.**Scalability:** As blockchain networks expand in scale, they may become sluggish and expensive to run. For wider adoption, scalability issues must be resolved.

2.**electricity Usage:** A few blockchain networks, including Bitcoin, need a lot of electricity. This has sparked environmental concerns, and more energy-efficient methods are being investigated.

3.Interoperability: For blockchain to realize its full potential, it must be able to work with other systems and technologies already in use.

4.**User Adoption:** User education and intuitive user interfaces are necessary to ensure that blockchain technology is widely used. For non-technical people, the technology might be complicated.

5.**Data security:** Blockchain not only encrypts data, but also greatly increases data transparency. It's critical to strike the correct balance between openness and privacy, especially in delicate scientific fields.

Table 1

Correlations

		Blockchain Technology	Blockchain Technology	Fish Taxonomy	Fish Taxonomy	Specimen Records	Specimen Records
Blockchain Technology	Pearson Correlation	1	.388**	.468**	-.008	.028	-.082
	Sig. (2-tailed)		.005	.001	.958	.848	.570
	N	50	50	50	50	50	50
Blockchain Technology	Pearson Correlation	.388**	1	.360*	.301*	-.124	.047
	Sig. (2-tailed)	.005		.010	.034	.392	.748
	N	50	50	50	50	50	50
Fish Taxonomy	Pearson Correlation	.468**	.360*	1	-.106	-.104	-.363**
	Sig. (2-tailed)	.001	.010		.465	.473	.010
	N	50	50	50	50	50	50
Fish Taxonomy	Pearson Correlation	-.008	.301*	-.106	1	-.144	.396**
	Sig. (2-tailed)	.958	.034	.465		.319	.004
	N	50	50	50	50	50	50
Specimen Records	Pearson Correlation	.028	-.124	-.104	-.144	1	.227
	Sig. (2-tailed)	.848	.392	.473	.319		.113
	N	50	50	50	50	50	50
Specimen Records	Pearson Correlation	-.082	.047	-.363**	.396**	.227	1
	Sig. (2-tailed)	.570	.748	.010	.004	.113	
	N	50	50	50	50	50	50

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

The above result describes the correlation between the blockchain technology result present that significantly relation with each indicator. The result describes that 39%, 4%, 11%, and 2% significantly relation between independent and dependent variables.

Conclusion

To attain these benefits, it's critical for those involved in this industry to thoroughly evaluate their unique requirements and consider how blockchain technology might be incorporated into their current data management procedures. It allows researchers to confidently communicate, track the origin of data, and confirm it. Even if there are still issues, blockchain technology has the potential to significantly improve data integrityBlockchain has many applications in finance, healthcare, supply chain management, and science. Blockchain lays the groundwork for safe, open, and responsible data management in data analysis. It's crucial to remember that implementing blockchain technology has drawbacks, including scalability, energy consumption, and the requirement for network participant unanimity. Data quality control continues to be a crucial component of any

data management system because, even though blockchain may guarantee data integrity inside its ecosystem, it cannot guarantee the veracity of the data first submitted into the system. Blockchain technology can offer a solid foundation for upholding data integrity in fish specimens and taxonomy records, promoting trust, cooperation, and transparency in scientific study and conservation activities. The field of scientific study, conservation, and fisheries management would greatly benefit from using blockchain technology to maintain data integrity in fish taxonomy and specimen records. With its transparency and decentralized structure, immutability, and tamper-proof features, blockchain solves many of the problems related to data management in this field.

The research determine that relation between the independent and dependent variables. the research concluded that overall research shows significant relation between them. Data integrity and research have entered a new age due to blockchain technology. Its decentralized, transparent, and irreversible characteristics make it an effective tool for academics, businesses, and anyone who want to guarantee the reliability of their data. It's important to recognize the difficulties with scaling and energy usage that come with using a blockchain. Research study accept the alternative hypothesis between them. Furthermore, it's still important to consider the data's accuracy when it was first entered into the system. The reliability and openness of fish taxonomy and specimen records may be improved using blockchain technology, ultimately leading to more successful scientific research, conservation initiatives, and fisheries management. The influence of technology on data-driven research and decision-making will surely be significant as it develops further.

References:

Astill, J., Dara, R. A., Campbell, M., Farber, J. M., Fraser, E. D., Sharif, S., & Yada, R. Y. (2019). Transparency in food supply chains: A review of enabling technology solutions. *Trends in Food Science & Technology, 91*, 240-247.

Bedane, T. D., Agga, G. E., & Gutema, F. D. (2022). Hygienic assessment of fish handling practices along production and supply chain and its public health implications in Central Oromia, Ethiopia. *Scientific Reports, 12*(1), 13910.

Blaha, F., & Katafono, K. (2020). Blockchain application in seafood value chains. *FAO Fisheries and Aquaculture Circular*(C1207), I-43.

Dhinakaran, D., & Prathap, P. J. (2022). Protection of data privacy from vulnerability using two-fish technique with Apriori algorithm in data mining. *The Journal of Supercomputing, 78*(16), 17559-17593.

Dutta, P., Choi, T.-M., Somani, S., & Butala, R. (2020). Blockchain technology in supply chain operations: Applications, challenges and research opportunities. *Transportation research part e: Logistics and transportation review, 142*, 102067.

Feng, H., Wang, W., Chen, B., & Zhang, X. (2020). Evaluation on frozen shellfish quality by blockchain based multi-sensors monitoring and SVM algorithm during cold storage. *IEEE Access, 8*, 54361-54370.

Feng, H., Zhang, M., Gecevska, V., Chen, B., Saeed, R., & Zhang, X. (2022). Modeling and evaluation of quality monitoring based on wireless sensor and blockchain technology for live fish waterless transportation. *Computers and Electronics in Agriculture, 193*, 106642.

George, G. M., & Jayashree, L. (2022). Fusion of Blockchain-IoT network to improve supply chain traceability using Ethermint Smart chain: A Review. *KSII Trans. Internet Inf. Syst, 16*, 3694-3722.

Hang, L., Ullah, I., & Kim, D.-H. (2020). A secure fish farm platform based on blockchain for agriculture data integrity. *Computers and Electronics in Agriculture, 170*, 105251.

Khan, M. A., Hossain, M. E., Shahaab, A., & Khan, I. (2022). ShrimpChain: A blockchain-based transparent and traceable framework to enhance the export potentiality of Bangladeshi shrimp. *Smart Agricultural Technology, 2*, 100041.

Oliveira, J., Lima, J. E., da Silva, D., Kuprych, V., Faria, P. M., Teixeira, C., . . . da Cruz, A. M. R. (2021). Traceability system for quality monitoring in the fishery and aquaculture value chain. *Journal of Agriculture and Food Research, 5*, 100169.

Olsen, P., Borit, M., & Syed, S. (2019). Applications, limitations, costs, and benefits related to the use of blockchain technology in the food industry. *Nofima rapportserie*.

Patro, P. K., Jayaraman, R., Salah, K., & Yaqoob, I. (2022). Blockchain-based traceability for the fishery supply chain. *IEEE Access, 10*, 81134-81154.

Tsolakis, N., Niedenzu, D., Simonetto, M., Dora, M., & Kumar, M. (2021). Supply network design to address United Nations

Sustainable Development Goals: A case study of blockchain implementation in Thai fish industry. *Journal of Business Research, 131*, 495-519.

Wang, X., Yu, G., Liu, R. P., Zhang, J., Wu, Q., Su, S. W., . . . Liu, T. (2021). Blockchain-enabled fish provenance and quality tracking system. *IEEE Internet of Things Journal, 9*(11), 8130-8142.

Xu, Y., Li, X., Zeng, X., Cao, J., & Jiang, W. (2022). Application of blockchain technology in food safety control : current trends and future prospects. *Critical reviews in food science and nutrition, 62*(10), 2800-2819.