Peer-Review

Kim, Andrew. 2026. “Devising Modern Fintech Solutions to Combat Global Illegal, Unreported and Unregulated Fishing and Protect Marine Ecosystems.” *Journal of High School Science* 10 (1): 1–13. https://doi.org/10.64336/001c.155112

1.The blockchain’s weakest point is the human(s) who makes entries into this ledger. Bad actors can easily falsify ledger entries and under-report fish catches. It is not feasible to install cameras and live surveillance on every boat (although see point 4). You would need to set up weigh stations at offloading ports or docks (this can easily be circumvented by transferring the illegally caught fish to other boats who do not use authorized ports or docks).
2.There is no incentive for local fishing communities to participate. These poverty stricken fishermens’ main concern is to put food on the table; getting loans on favorable terms does little for them. However, if they could be provided with expertise (along with loans) to start aquaculture farms (for example), that would mitigate the overfishing problem. However, a seashore does not offer the ideal environment to start an aquaculture farm.
3.The successes you mention, identifying fish species and counting/reducing or gathering plastic have nothing to do with overfishing.
4.Mandate that all fishing boats above a certain size have accelerometers, hull immersion depth meters, multimeters, GPS systems and underwater cameras installed with data collected from these devices available to authorities. Construct and train AI models that can predict the probability that a fishing vessel has been actively fishing for (x hours) using GPS trajectories, speed, stop-and-go, underwater camera images, power draw of engine or drivetrain and hull immersion depth. If the amount of time of fishing is incommensurate with the amount of fish recorded (this can be automatically input into a blockchain) when the boat docks after a fishing run, this can be taken as fraudulent overfishing activity and can be fined accordingly. If however, the amount of time of fishing is commensurate with the amount of fish caught (and reported), the fintech financial and loan incentives can then be activated for that boat/organization.
Please discuss these points and comments in the manuscript and remove extraneous and non-related content such as plastic detection and imaging fish species.

“The blockchain’s weakest point is the human(s) who makes entries into this ledger. Bad actors can easily falsify ledger entries and under-report fish catches. It is not feasible to install cameras and live surveillance on every boat (although see point 4). You would need to set up weigh stations at offloading ports or docks (this can easily be circumvented by transferring the illegally caught fish to other boats who do not use authorized ports or docks).”

a. Section 7: Blockchain Vulnerabilities and Mitigations: Though blockchains offer immutable records, the human actors who input the data are easily susceptible to corruption and error. One possible solution introduces weighing stations at ports, checking the weight of fish caught. However, it can be mitigated through transferring illegally caught fish to other boats who do not use ports or weighing stations.

b. This paragraph, not previously submitted, has now been added into my paper.

2. There is no incentive for local fishing communities to participate. These poverty stricken fishermens’ main concern is to put food on the table; getting loans on favorable terms does little for them. However, if they could be provided with expertise (along with loans) to start aquaculture farms (for example), that would mitigate the overfishing problem.
However, a seashore does not offer the ideal environment to start an aquaculture farm.

a. Section 7: Since coastal communities may not find the greatest value within enhanced banking access, as loans are not as favorable to them, other benefits could include: access to premium markets for sustainable seafood, and training in aquaculture systems. These would

include training in options such as seaweed farms to reduce reliance on overfished stocks, not replacing fishing entirely.

b. This paragraph discusses more possible benefits sustainable fishers may be able to enjoy, as simple loan benefits might not entice these fishermen enough, which I previously had.

3. The successes you mention, identifying fish species and counting/reducing or gathering plastic have nothing to do with overfishing.

a. Cut these sections out of my paper:

b. “Giesecke+Devrient, a digital security company, decided to tackle a different problem: plastic pollution. Giesecke+Devrient partnered with Parley for the Oceans to create payment cards from recycled marine plastic, known as Parley Ocean Plastic cards. The company has also made the packaging of the envelope and the glue plastic-free, using recycled paper material instead. This not only proves how there should not be reliance on “virgin plastics”, or using plastics for one time, but also spreads awareness to various customers and banks to make choices to contribute to environmental preservation. This company has successfully created 45,000 Visa debit cards made from marine plastic waste.[19] However, not all companies need to come up with a creative solution to help.

Headline INC donates a portion of all Crypto NFT sales to the marine conservation group Whale and Dolphin Conservation. This group focuses on the fact that whales and dolphins are integral contributors to the ecosystem. Headline Inc. is built on Algorand, a unique carbon-neutral blockchain protocol.[20] Downing Investing invests money into sustainable solutions for the world. This investment platform was established in London in 1986. The firm invests customers’ money into businesses that are involved in sustainability, while also making returns for their portfolios. As of June 30, 2024, Downing Investing had quite a hefty sum, proving their ability to make a difference: having £2.1 billion in assets under management. Their certification as a B Corporation in 2022 reflects a commitment to sustainability alongside financial returns.[21] Downing gets an evaluation of the carbon footprint of their investments and supports financing renewable energy projects. Various technology companies of all markets are investing into marine life for the future, proving the potential market value for sustainable solutions as well as the need to conserve ocean species.

c. AI can also be utilized to help cleanup efforts. When provided with satellite images, AI can alert cleanup organizations and the community about oil spills or plastic waste, which can generate faster cleanup efforts.

d. First, AI is able to track marine species. AI-powered sensors and underwater cameras monitor marine species and their habitats. The AI then analyzes the data to track movements, behaviors, and population trends. AI can also aid fisheries that are aiming to become sustainable. To do this, AI analyzes the data on fish populations, migration patterns, and fishing activities. This way, the AI can predict future fish stock levels, and from there set sustainable catch limits and prevent overfishing.[25]

e. Fishial.AI is an example of AI already making an impact on the world. Their company aims to create a machine learning AI that will be able to identify fish species accurately. Not all have to implement AI to clean up the ocean, however, as there have been inventions that require manual labor. The Ocean Cleanup Array, created by Boyan Slat, tackles the problem of large-scale plastics in the ocean. It uses floating barriers, which are placed strategically, to collect plastics floating along ocean currents. This system simplifies the collection and recycling of ocean plastics. Another innovation, WasteShark, created by Richard Hardiman, which is a robot designed to collect ocean pollution trash. It has a storage of 1,100 pounds. Another notable invention is the SpongeSuit, a bikini made from a special

material capable of absorbing pollutants at up to 25 times its weight. To do this, as the wearer swims in a body of water, it collects chemicals and pollutants without actually harming the wearer.[26] These technological inventions demonstrate the
desire and ability humanity holds to restore and protect our oceans."

4. Mandate that all fishing boats above a certain size have accelerometers, hull immersion depth meters, multimeters, GPS systems and underwater cameras installed with data collected from these devices available to authorities. Construct and train AI models that can predict the probability that a fishing vessel has been actively fishing for (x hours) using GPS trajectories, speed, stop-and-go, underwater camera images, power draw of engine or drivetrain and hull immersion depth. If the amount of time of fishing is
incommensurate with the amount of fish recorded (this can be automatically input into a blockchain) when the boat docks after a fishing run, this can be taken as fraudulent overfishing activity and can be fined accordingly. If however, the amount of time of fishing is commensurate with the amount of fish caught (and reported), the fintech financial and loan incentives can then be activated for that boat/organization.

a. Section 7: Installing low cost Vessel Monitoring Systems (VMS), including GPS trackers, accelerometers, and basic cameras, can deter desires of possible participation in IUU fishing. For example, with vessels above a certain size (>10 meters), it will be required to install such technology with data automatically fed into a blockchain-based ledger. For others in need of affordability, low cost and low maintenance systems can be subsidized by governments, Non-Governmental Organizations (NGO's), or international bodies, and have already been put into use. In Timor-Leste, a solar-powered monitoring system using basic GPS and digital tech was launched in 2019, providing near-real-time data at minimal cost to fishers, with funding from development partners like WorldFish[22]. This model relies on affordable components and community training, making it scalable for
low-income areas. Prototype architectures using long-range, low-power wireless tech networks (LoRaWAN) have been developed to track small vessels at a fraction of traditional VMS costs, being energy-efficient and not requiring constant power, ideal for boats without reliable electricity[23].

These solutions could provide a safeguard for anyone trying to fool the weighing system, ensuring sustainable fishing.

Please discuss these points and comments in the manuscript and remove extraneous and non-related content such as plastic detection and imaging fish species.

The paper still contains content not relevant to the title or premise. The plastic bank blockchain; for example; has nothing to do with overfishing. The green climate fund, projects to reduce greenhouse gases or carbon emissions do not significantly affect overfishing. Please remove all content extraneous to over-fishing from the manuscript.

1.Please include AI verbage: "….Construct and train AI models that can predict the probability that a fishing vessel has been actively fishing for (x hours) using GPS trajectories, speed, stop-and-go, underwater camera images and turbidity, power draw of engine or drivetrain, fuel levels, vessel list-to-roll ratio, propeller RPM, and hull immersion depth. If the amount of time/location of fishing is incommensurate with the amount of fish recorded (this can be automatically input into a blockchain) when the boat docks after a fishing run, this can be taken as fraudulent overfishing activity and can be fined accordingly. If however, the amount of time of fishing is commensurate with the amount of fish caught (and reported), the fintech financial and loan incentives can then be activated for that boat/organization." This is important since AI models can be trained to utilize the data from these devices to arrive at a binary "overfishing" or "no overfishing" result, before the boat or vessel returns to port (see table attached).
Please also include this table in the manuscript.

5. The paper still contains content not relevant to the title or premise. The plastic bank blockchain; for example; has nothing to do with overfishing. The green climate fund, projects to reduce greenhouse gases or carbon emissions do not significantly affect overfishing. Please remove all content extraneous to over-fishing from the manuscript.

b. Section 2: Overfishing Drives Species Extinction and Habitat Destruction

- At first I had: "while seagrass helps absorb carbon dioxide, slowing the decay rate for harmful gases in the atmosphere." (Direct climate benefit unrelated to overfishing)
- Changed to: "while seagrass helps absorb carbon dioxide, slowing the decay rate for harmful gases in the atmosphere, as well as providing habitat for juvenile marine species." (fishing-relevant phrase but kept the carbon mention)

c. Section 6 ("Modern Inventions Aid Oceans")

- Deleted whole section as it was focused on Plastic Bank Blockchain and ocean plastic pollution, which has nothing to do with IUU fishing

d. Old Section 7 (Now Section 5):

- Removed the latter half of this section which discussed the UN Green Climate Fund, taxes on carbon emissions, and general crowdfunding, as these financial mechanisms were targeted at greenhouse gases and global temperatures, not overfishing

e. Section 4 ("Fintech Innovations..."):

- removed the reference to "Aspiration and "GreenFi" (a climate fintech focused on carbon footprints)
- Deleted Old Section 5 ("Technology Tracks Sustainable Seafood..."):
- Removed the section discussing Seafood Watch and IBM Food Trust as they are consumer-side supply chain solutions as they are not related to vessel-side enforcement and financial incentives for fishermen.

f. Introduction:

- Removed mentions of "medicines and biofuels" and the ocean acting as a "carbon sink."

5. Please include AI verbage: "….Construct and train AI models that can predict the probability that a fishing vessel has been actively fishing for (x hours) using GPS trajectories, speed, stop-and-go, underwater camera images and turbidity, power draw of engine or drivetrain, fuel levels, vessel list-to-roll ratio, propeller RPM, and hull immersion depth. If the amount of time/location of fishing is incommensurate with the amount of fish recorded (this can be automatically input into a blockchain) when the boat docks after a fishing run, this can be taken as fraudulent overfishing activity and can be fined accordingly. If however, the amount of time of fishing is commensurate with the amount of fish caught (and reported), the fintech financial and loan incentives can then be activated for that boat/organization." This is important since AI models can be trained to utilize the data from these devices to arrive at a binary "overfishing" or "no overfishing" result, before the boat or vessel returns to port (see table attached).

a. Section 5: Financial Incentives and Blockchain to Ensure Marine Sustainability.

- Inserted the specific paragraph provided:
- "Construct and train AI models that can predict the probability that a fishing vessel has been actively fishing for (x hours) using GPS trajectories, speed, stop-and-go... If the amount of time/location of fishing is incommensurate with the amount of fish recorded... this can be taken as fraudulent overfishing activity..."

6. Please also include this table in the manuscript.

a. Section 5: Financial Incentives and Blockchain to Ensure Marine Sustainability.

- inserted Table 1: Sensor data and AI predictive contribution for detecting active fishing versus transit.

Thank you for addressing my comments. The manuscript is much improved.

I would now improve your idea of the deFi aspect of this paper. Please see THE ATTACHED DIAGRAM/FIGURE where your multisensor data from the fishing vessel is directly fed into a block-chain oracle such as Chainlink. This data is then operationalized by an off-chain AI algorithm which outputs a composite fishing activity index score and a confidence-weighted violation score. Based on a prior pre written and stakeholder approved smart-contract written into the blockchain, these scores then directly unlock liquidity or interest rate reduction mechanisms from deFi platforms such as Uniswap or Aave that are designed also to ingest non-financial data. The liquidiy or interest rate reduction protocols are over-collateralized using assets such as fishing vessels, fishing rights, contracts and licenses. Once unlocked, these loans/or liquidity is directly deposited into fishing vessel operators' financial accounts as USDC cryptocurrency backed by US dollars.
You will not want to position this part of the contribution in detail as regards novelty as 'Real-time compliance data programmatically alters lending terms on decentralized finance protocols'. Make sure you convey that the deFi aspect of this paper is systems / architecture whose contribution is mechanism design, not necessarily empirical deployment.
Specifically novel elements include:
Oracle-mediated compliance feeds (Chainlink as a bridge from physical-world sensors)
AI-based compliance scoring used as an on-chain financial variable
Automatic interest-rate and liquidity adjustments via deFi liquidity platforms such as Aave and/or Uniswap.
No human intermediary
Capital cost as enforcement, not fines or subsidies
This is NOT standard in either Fisheries governance, or DeFi applications (which rarely ingest real-world compliance signals), hence positions your work as being novel.
Here are some more sentences to enhance novelty:
1."To our knowledge, no prior work treats environmental compliance as an on-chain financial risk variable governing liquidity access"
2."Using fishing vessels, licenses, quotas, and contracts as collateral conditioned on behavior is still relatively unexplored academically especially when collateral value is dynamically adjusted based on compliance and the proposal is not just static tokenization."
3."We propose a novel closed-loop enforcement mechanism in which multi-sensor fisheries compliance data is transformed via AI and oracle services into on-chain financial signals that automatically adjust lending terms in decentralized finance protocols. Unlike prior incentive-based approaches, compliance directly and programmatically reduces the cost of capital, creating continuous, behavior-linked enforcement without centralized oversight."
Below is a re-written abstract:
Illegal, unreported, and unregulated (IUU) fishing remains a major threat to marine ecosystems and coastal livelihoods, yet existing enforcement mechanisms rely on periodic inspections, manual reporting, or static financial incentives. We propose a novel closed-loop compliance-to-finance system in which multi-sensor vessel data are transformed into real-time financial signals that directly govern access to capital. In the proposed architecture, heterogeneous onboard and port-side sensors feed into an off-chain AI compliance model whose outputs are transmitted on-chain via decentralized oracle services. These compliance attestations programmatically adjust lending terms in decentralized finance (DeFi) protocols, dynamically reducing interest rates and increasing liquidity for compliant operators while restricting capital access for non-compliance. Loans are issued in USD-pegged stablecoins and overcollateralized using real-world fishing assets, including vessels, licenses, quotas, and contracts. Unlike prior approaches that treat sustainability incentives as external subsidies or reputational mechanisms, this system embeds regulatory compliance directly into the cost of capital, creating continuous, automated enforcement without centralized intermediaries. We illustrate the feasibility of this architecture using existing low-cost sensing technologies, oracle infrastructure, and DeFi lending primitives,

and discuss its potential to expand sustainable financing in small-scale and low-income fisheries where IUU fishing is most prevalent.
Please incorporate these comments into the manuscript and ensure that flow is maintained throughout the document. With these additions, your original idea has now been articulated so that its contribution is eviident and clear.

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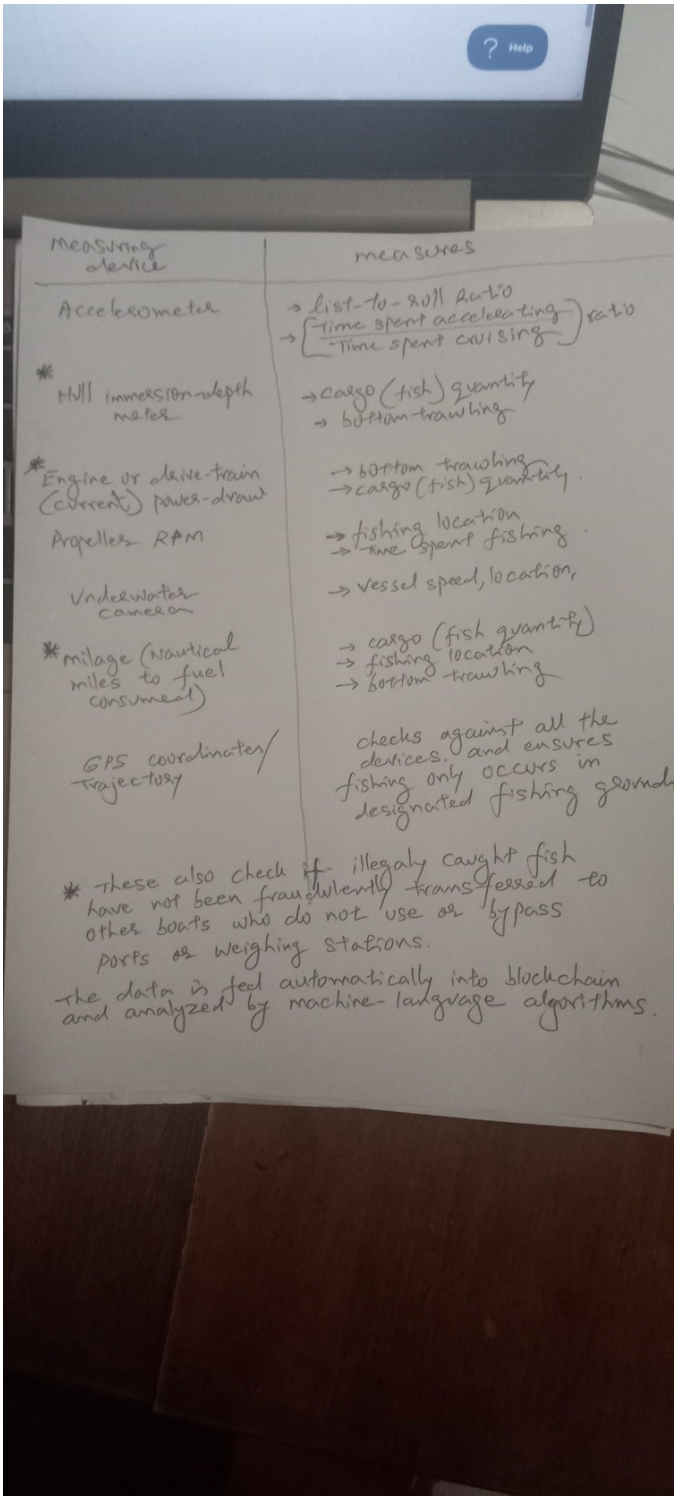

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b. Section 5 ("Financial Incentives and Blockchain to Ensure Marine Sustainability")

- Included Chainlink, off-chain AI, CFIAS/CWVS, smart contracts, DeFi platforms, overcollateralization, USDC in paragraph starting "In this architecture, multi-sensor data..."
- Following paragraph includes the exact novelty sentence about dynamic collateral and lists the specific novel elements (oracle-mediated feeds, AI scoring on-chain, automatic adjustments, no intermediaries, capital cost enforcement)
- Paragraph at the end expands on it as a detailed walkthrough, matching the diagram's intended flow

7. Specifically novel elements include:

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a. Section 5 ("Financial Incentives and Blockchain to Ensure Marine Sustainability")

- Second to last paragraph:
- "Specifically novel elements include: oracle-mediated compliance feeds (Chainlink as a bridge from physical-world sensors), AI-based compliance scoring used as an on-chain financial variable, automatic interest-rate and liquidity adjustments via DeFi liquidity platforms such as Aave and/or Uniswap, no human intermediary, and capital cost as enforcement, not fines or subsidies."

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approaches, compliance directly and programmatically reduces the cost of capital, creating continuous, behavior-linked enforcement without centralized oversight."

a. **End of Section 4** ("Fintech Innovations Foster Sustainable Fishing Practices"), right after the discussion of Blue Bonds:

i. "While Blue Bonds provide macro-level debt restructuring, decentralized finance (DeFi) offers micro-level, real-time incentives by embedding compliance directly into lending terms. **To our knowledge, no prior work treats environmental compliance as an on-chain financial risk variable governing liquidity access.** We propose a novel closed-loop enforcement mechanism…"

b. **Section 5** ("Financial Incentives and Blockchain to Ensure Marine Sustainability"):

i. "Using fishing vessels, licenses, quotas, and contracts as collateral conditioned on behavior is still relatively unexplored academically especially when collateral value is dynamically adjusted based on compliance and the proposal is not just static tokenization. This approach positions the DeFi aspect as a systems architecture…"

c. Section 4:

i. "To our knowledge, no prior work treats environmental compliance as an on-chain financial risk variable governing liquidity access. **We propose a novel closed-loop enforcement mechanism in which multi-sensor fisheries compliance data is transformed via AI and oracle services into on-chain financial signals that automatically adjust lending terms in decentralized finance protocols. Unlike prior incentive-based approaches, compliance directly and programmatically reduces the cost of capital, creating continuous, behavior-linked enforcement without centralized oversight."**

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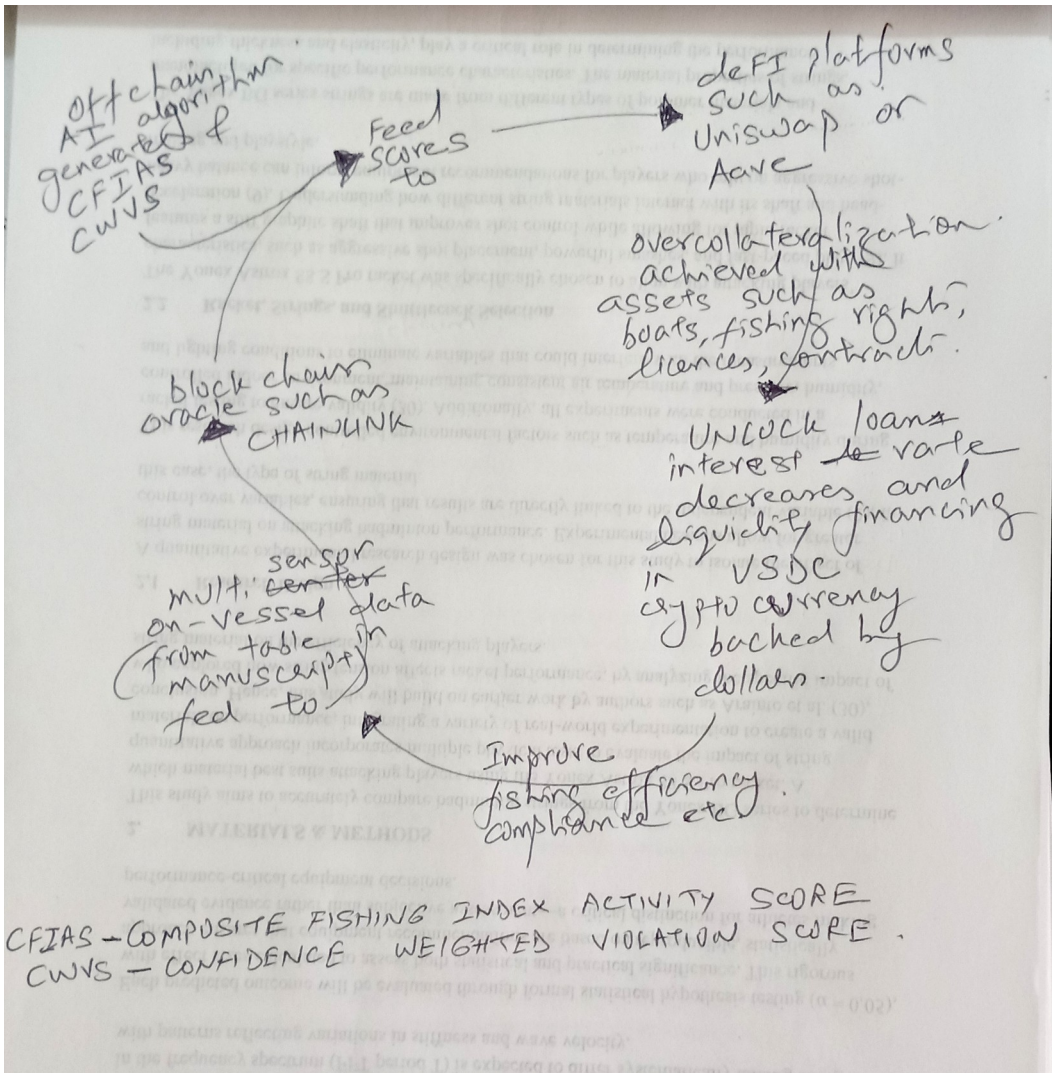
d. Abstract:

i. Replaced old abstract with new reworded one for clarity.

Please incorporate these comments into the manuscript and ensure that flow is maintained throughout the document. With these additions, your original idea has now been articulated so that its contribution is evident and clear.



Thank you for addressing my comments. Accepted.
I have added and revised content to better reflect your idea and concept. Please check the galley proof thoroughly and make sure you are in agreement with the changes.