2.2 Artificial intelligence and big data

Collecting the data is merely the first step. What really causes headaches is how to determine what to do next when faced with a bunch of numbers. At this point, artificial intelligence and big data analysis come into play. They are more like a "background system", specifically responsible for identifying patterns from the chaotic data and providing relatively clear instructions. Nowadays, many breeding farms are attempting to use models to predict changes in water quality or assist in assessing the risk of fish diseases (Idoko et al., 2025). Some situations that were previously difficult to explain, such as sudden deaths of fish and shrimp, or oxygen deficiency in the water body in the morning, can also be detected in advance through data backtracking and trend analysis, thereby reducing losses. This does not mean that the problems can be completely avoided, but at least it is no longer necessary to make remedial efforts after the fact.

If artificial intelligence is directly linked with existing Internet of Things systems, which is often described as AIoT, its use is no longer limited to simple monitoring. In practice, this connection allows farming operations to respond more flexibly to what is actually happening in the pond. For example, feeding does not have to follow a fixed schedule. It can be adjusted according to how fast the fish are growing and how actively they are feeding. In some cases, different pieces of equipment can also be connected and respond automatically when conditions change (Chen and Huang, 2025).

These adjustments do not attract much attention, and taken individually they are easy to pass over. With time, however, their influence on everyday work becomes harder to ignore. Tasks that once required repeated manual handling are now performed less often by hand, feeding decisions are approached with more caution, and the most obvious forms of waste are easier to pick out and keep under control. Gradually, this changes how feed and related inputs are managed, weakening routines that were largely built on habit and accumulated experience rather than deliberate planning (Huang and Khabush, 2025).

Seen from a wider angle, the introduction of intelligent technologies into traditional fisheries is clearly not driven by sudden breakthroughs. Instead, small adjustments are made one after another, and many of them blend into existing practices without drawing much attention. What stands out is a change in how decisions are made. Choices that once relied almost entirely on personal judgment are now more often compared with data before action is taken. The process is slow and uneven, but it is beginning to influence everyday operational decisions in a steady way. In the fishing industry, AI can process data such as vessel tracking and satellite images to achieve intelligent identification of fishing vessels and fish stocks, estimate the catch volume, and detect traces of illegal fishing. Globally, AI can uncover the patterns of fishing activities and provide a basis for regulation and policy-making. However, the application of AI is constrained by issues such as data acquisition and standardization. It requires collaboration among fishery administrators, fishermen, and developers, and adaptation to actual needs, in order to transform AI from experimental applications into reliable fishery information systems.

2.3 Synergistic integration of remote sensing, unmanned systems and blockchain technology

Remote sensing, unmanned systems, and blockchain are integrating with the Internet of Things and AI to build a complete intelligent fishery system. Satellite remote sensing and drone images can make up for the shortcomings of on-site monitoring. Combined with ship data and AI, it can enhance the scope and efficiency of fishery supervision. Drones and unmanned ships are becoming increasingly common in the fishing industry and are quite practical. For instance, fishermen often use them to inspect fish cages and estimate the number of fish, and the operation is very convenient. As a result, the coverage of the Internet of Things becomes wider, and staff no longer need to frequently go to sea, which not only reduces operational risks but also significantly saves monitoring costs. What's more noteworthy is that if multiple devices work together, even those more complex monitoring tasks can be successfully handled (Idoko et al., 2025).

Blockchain has also begun to find its place in fisheries, although its role is sometimes easier to see in practice than in theory. Put simply, it offers a way to make fishery-related data more reliable and easier to trace. In seafood trade, for example, information can be recorded from the moment the catch is landed through processing and