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An Effective Risk Management Method with Accurate Water Quality Measuring System in Fish Farm

[1]Heung-Soe Kim, [2]Woori Ko and [3]JaeSoo Yang
[1]Globit Co. Ltd., 2-7 Bokji-ro 3-gil, 63220 Jeju-si, Jeju, South Korea
[2]Globit Co. Ltd., Jeju-si, 63220 Jeju, South Korea
[3]Department of Electronics and Electrical Engineering, Dankook University,
152 Jukjeon-ro, Suji-gu, Yeongin-si, Gyeonggi Province, Korea

Abstract: It is required to check the fishery environment in real time and respond to emergency situations, thereby reduce the mortality rate in fish farm. The marine cage farms in Korea are vulnerable to natural disasters such as high temperature and red tide because they are concentrated in semi-enclosed coastal areas and inner areas with low seawater circulation and hydraulically stable. Inaccurate water quality information management has caused massive human deaths, resulting in an increase in the production cost of farmed fisheries and a decrease in competitiveness. In order to solve these problems, a variety of fish farm technologies are being developed in the world. In this study, we introduce the developed technologies to minimize the risks of proposed fish farm management and suggest ways of using this system to enhance competitiveness. As a result each relevant organization can monitor and predict in advance, so that, we can actively cope with emergency fishing village and fishing farm effectively.

Key words: Aquaculture management, risk management, quality information measurement, internet of things, smart fish farm, farm technologies

INTRODUCTION

It is essential to increase the production of aquatic products through artificial forms. It is a trend that recognizes the limitation of the production of natural aquatic products worldwide and strengthens the policy support for the increase of production through the development of aquaculture technology. However, in recent years, there are growing risk factors for farm management due to excessive fishery development, increased management costs and disease outbreaks.

Marine caged fish culture has been steadily growing since its introduction in Tongyeong coast in 1975. In the 2000s, “Fisheries upbringing law” was enacted and “Fishery development basic plan” was established. The production capacity of the aquaculture industry sharply increased. In addition, as international standards for sanitation and safety are being strengthened, Management and aquatic hygiene and safety management (Anonymous, 2015).

In order to solve these problems, a variety of aquaculture technologies are being developed in the world. In addition, as the international norms are strengthened, there is a growing demand for new aquaculture technologies. As consumer’s demands for aquaculture diversify, there is also a demand for the development of aquaculture technology in response to the consumption environment (Anonymouse, 2010, 2011, 2015, 2017a-d).

Therefore, the technical team has developed a pulley-type water quality measurement system using IoT based salinity difference anti-fouling and has accomplished technical achievements such as spreading it to farms in Tong Yeong and Geoje in Gyeongsangnam-do. And how to manage the external environmental risk.

MATERIALS AND METHODS

Staus of the aquaculture management activities: The attractiveness of the aquaculture industry can be highly appreciated when a stable rate of return is guaranteed, risks (actual returns <expected returns) are low and transparency of returns (actual returns-reported earnings reported to investors) is high. It is possible to increase the attractiveness of aquaculture by analyzing factors such as

Corresponding Author: JaeSoo Yang, Department of Electronics and Electrical Engineering, Dankook University, 152 Jukjeon-ro, Suji-gu, Yeongin-si, Gyeonggi Province, Korea

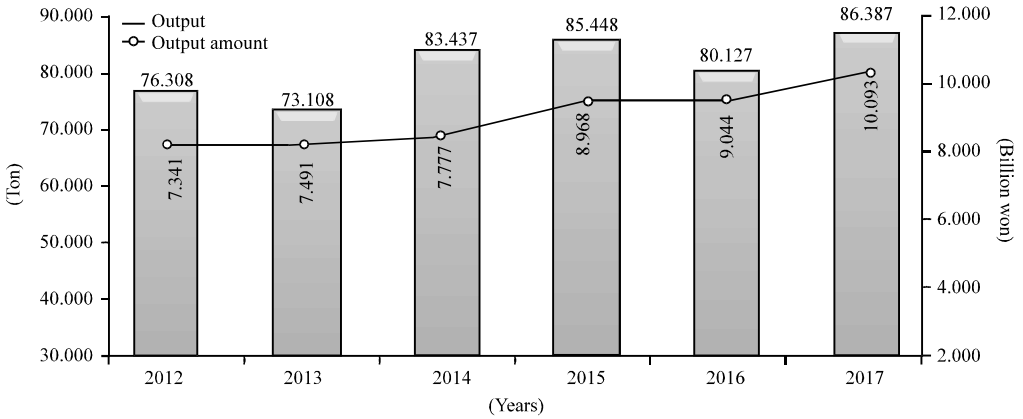

Fig. 1: Results of fish culture trend in the first half of 2017 (Statistics Korea)

financial status, policy, price volatility and marketability and building a business model for the aquaculture based on this. The level of cultivation technology, the marketability of the target cultivar and the operating cost of cultivation. This is a matter related to operating costs, and it is directly related to production cost and competitiveness, so, management is required.

The first step for ensuring resilience capability is to pinpoint and pinpoint what the threat is. Among the problems faced by the aquaculture industry in recent years, 68.1% of the factors (climate, water temperature, disease occurrence) directly affect the production. This implies that the probability of the death of aquaculture fish is increased due to climate change and there is a risk that the production cost of the variable cost such as the purchase price of the fry is severely changed according to the mortality rate.

Figure 1 shows the output and production amount from 2012-2017 as the trend of production and production changes over the last 6 years. The output for the 6 years rose by 13.2%, while the production cost of production increased by 37.4%. This is attributed to the increase in production due to high-temperature and natural disasters (such as red tides) and concerns about the occurrence of diseases and diseases (Anonymous, 2017a-d).

As a result, if we can actively cope with changes in the external environment such as high temperature and red tide and reduce feed rate, it means that we can strengthen the competitiveness of cultured fish by reducing the production cost. According to a study by the Korea Maritime Institute, the rate of increase in the rate of molting by 24.6-30% was up to 113% in the flounder culture which was 54.6% (Anonymous, 2017a-d). The results also show that using a system that manages external environmental risks such as technically high temperature and red tide can increase productivity by reducing mortality.

RESULTS AND DISCUSSION

Implementation of the risk management system: Water quality management system configuration: The Marine-S, a marine cage water quality measurement system developed by the technical team is an IoT based automatic water quality measurement system and can be installed and operated on a marine cage farm. IoT communication data is transmitted to the data center to analyze, water temperature, DO, etc., are monitored and alerted according to the threshold. Figure 2 illustrates Marine-S Water Quality Information and Measuring System.

As shown in Fig. 3, this system includes sensors that can measure water quality and can be measured by water depth according to the operation schedule. Depending on the function of the sensor, it can measure water quality such as water temperature, DO, pH, ORP and monitor the data on site or remotely.

Management system using system: The system described above allows monitoring of the surrounding water quality. Figure 4 shows a mobile-based monitoring system that enables real-time monitoring of surrounding conditions. An alarm system is embedded according to thresholds such as water temperature and DO.

It can check the fishery environment in real time and cope with an abnormal situation or when an alarm is issued. In case of high water temperature, it is possible to reduce production cost by minimizing the risk by coping with fish species and situations such as installation of cage shields, fast food fish farming and underground seawater feeding in case of onshore farms. In addition, the data of this system is also shared with related organizations, so that, each relevant organization can monitor and predict in advance, so that, it can actively

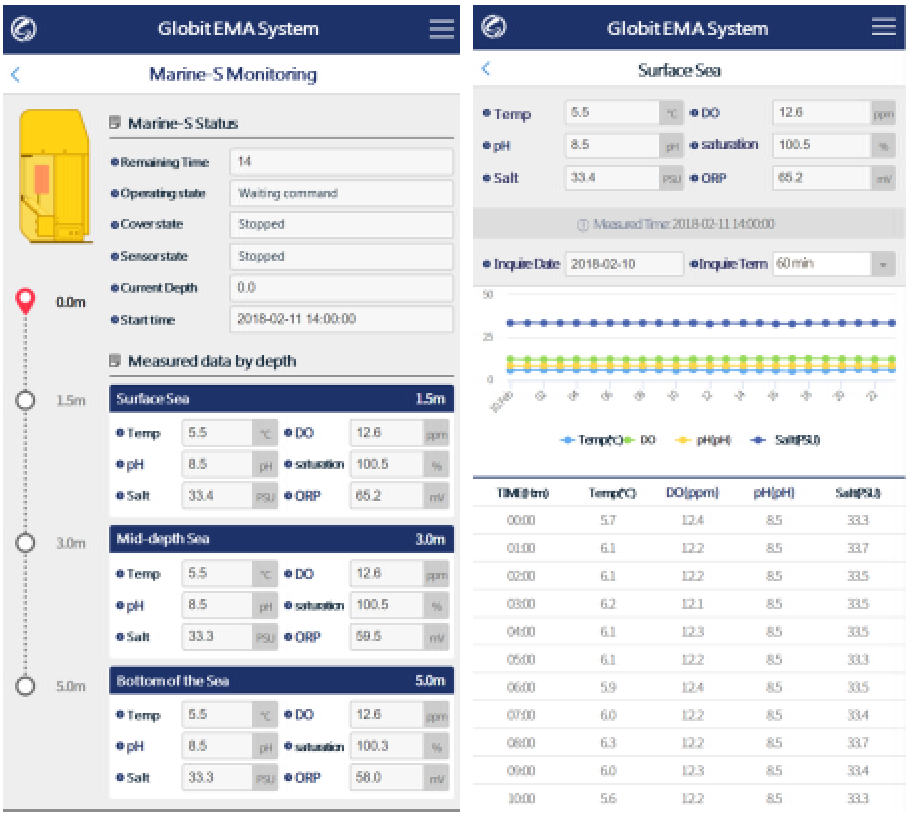

Fig. 2: Marine-S water quality information and measuring system

Fig. 3: Marine-S smart water quality measuring sense

Fig. 4: Mobile motoring and control application display

cope with emergency fishing village and farm fishing fish. Figure 5 shows overall IoT based anti-fouling automatic water quality measuring instrument. No-wash anti-fouling function and collecting sensor data function after setting various depths are shown in Fig. 4 as well as depth adjustable functions. The smart water quality measuring system provides a display for monitoring in the office for real time monitoring.

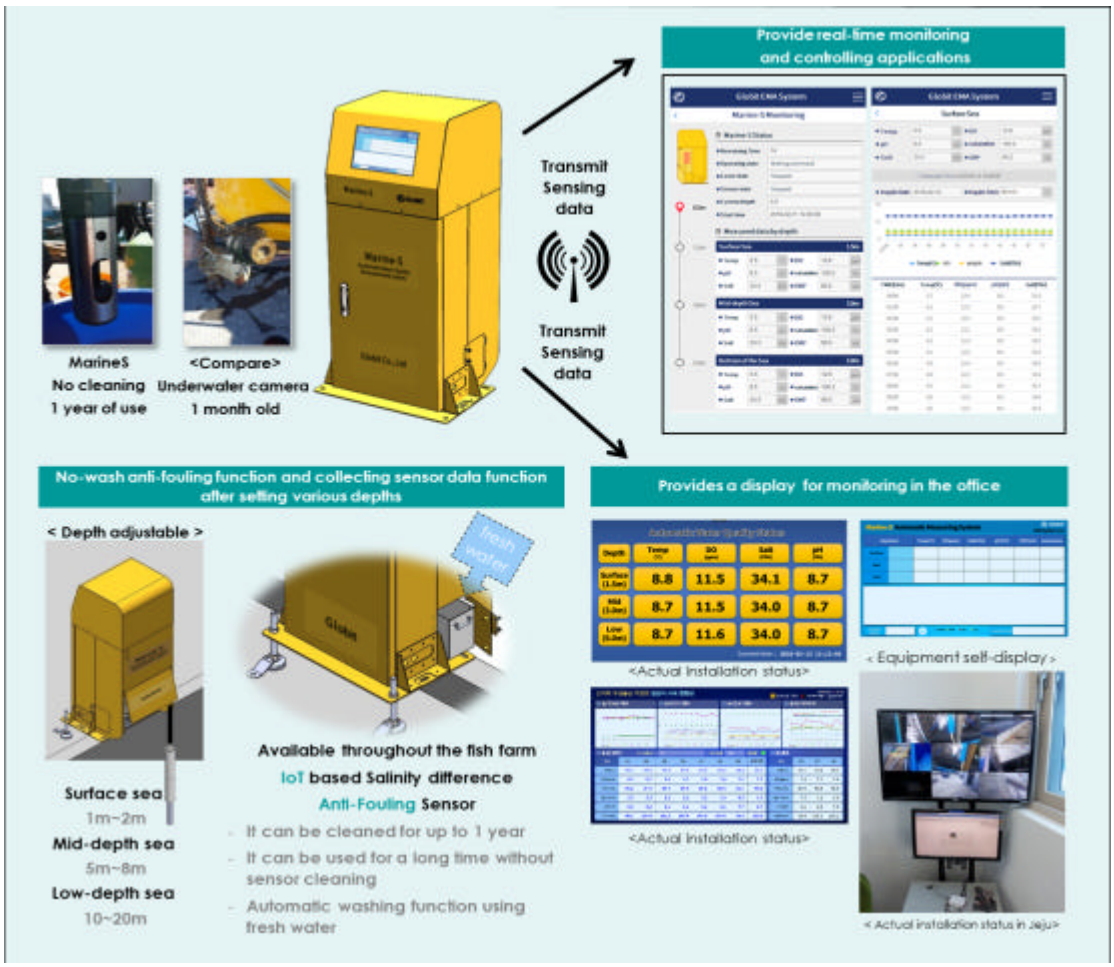

Fig. 5: Overall IoT based anti-fouling automatic water quality measuring system

CONCLUSION

The system installed in this system has a basis for strengthening competitiveness by checking the fishery environment in real time and responding to emergency situations, thereby reducing the mortality rate. It is possible to respond to each situation by making big data through accumulated data for several years and to make an AI-based intelligent prediction system to forecast the weather. However, there is a limitation that this system is installed in some areas. It is expected that the fishery will play a big role in enhancing the competitiveness by providing the nationwide maritime forecast by installing it in each sea of the whole country in the future.

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