Aerial Imagery-based Estimation of Marine Farming Facilities Capacity in Wando-gun, South Jeolla Province

Hye-Ji PARK, Gyeong-Min KANG and Myung-Hee JO

Abstract: The marine farming business is conducted in seas, making it difficult to identify the state of marine farms, and the illegal marine farming facilities worsen the fishing environment, and lead to the production and distribution of low-quality farmed marine products thus harming the appropriate supply of marine products and stabilization of prices.

Therefore, this study used high-resolution aerial images of Wando-gun, South Jeolla Province, Korea in estimating the facility capacity for laver, sea mustard, abalone, fish and oysters so the marine farms state was identified along with the identification of illegal marine farming. To that end, the marine farming approval book was arranged according to the standardized table so as to build attribute DB. The location and area map of the water surface was digitized based on the GPS coordinates, and thus a spatial DB was constructed. The DB then was integrated into a single GIS database and superimposed on the aerial imagery.

This study enables the estimation of the itemized facility capacity, making it possible to ensure a systematic management of marine farms, and to serve as the basic research data and estimate the output for production statistics agencies.

Keywords: Marine Farm, Marine Products, Aerial Image, Attribute DB, Spatial DB

1. Introduction

As the marine farming industry develops and the items of marine farming are diversified, there is a growing need to ensure the stable production of farmed marine products and the improvement of fishing environments. Since the marine farming facilities, however, are widely spread in the seas, they are difficult to identify, making it limited to calculate the facility quantity and production amount which are the basic data for the control of the demand and supply.

To tackle these problems, this study used aerial images with a 25cm spatial resolution in calculating the 2017 marine farming facilities for laver, sea mustard, abalone, fish, and oyster in Wando-gun, South Jeolla Province.

2. Research Process

2.1. Research Flow

The entire research flow is shown in Figure 1. The target of this research is Wando-gun, South Jeolla Province, and the filming course was selected by superimposing the approved marine farming areas and

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the location map of farming facilities. The filming period was selected as the time deemed the most suitable for identifying the farming facilities, so the filming was conducted five times from January 15 to February 2.

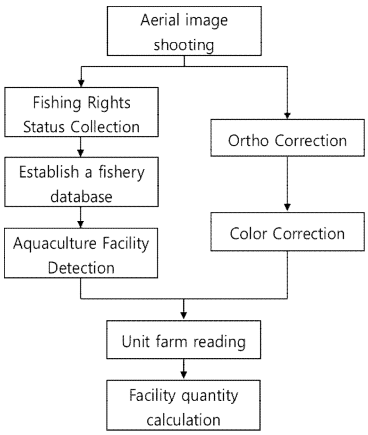


Figure 1. Research flow

2.2. Build a fish farm database

As of the end of 2016, the local government's license book for marine farms for laver, sea mustard, abalone, fish, and oyster, their sea surface location and zoning maps were secured, and they were reviewed by being compared with the already constructed DB, and thus the latest DB was constructed. The license book, which contains the license number, area, period, licensee, etc., was computerized so as to construct the DB of attributes. A spatial DB of the marine farms' location shown in the sea surface area and zoning maps was constructed. The constructed data was constructed in the type of the GIS data format, SHP(Shape file), so as to integrate attributes and spatial information. Further, DB of fishing grounds, constructed in various coordinate systems, was converted into the UTM-K/GRS80 system which is the standard coordinate system for national data integration.

2.3. Calculation of Marine Farm Quantity

The aerial-imagery-based licensed fishing grounds DB and marine farming facilities were classified according to the insides and outsides of licensed areas by ownership and to farming facilities. The reading standard for the licensed facilities is shown in Table 1.

Table 1. Reading standard for reading the licensed areas

Category		**Standard for reading**
Legal facilities		Located within the licensed area. Not exceeding the licensed allowable facility quantity.
Illegal facilities	More facilities than licensed	Located within the licensed area. Exceeding the licensed allowable facility quantity.
	Deviated facilities	Deviated from the licensed are. (Located outside the licensed area. The ownership is clear)
	Unlicensed facilities	Unlicensed. (Located outside the licensed area. The ownership is not clear).

Table 2. Standard for the calculation of facility quantity by item

Category		**Standard for reading**
Legal facilities		Located within the licensed area. Not exceeding the licensed allowable facility quantity.
Illegal facilities	More facilities than licensed	Located within the licensed area. Exceeding the licensed allowable facility quantity.
	Deviated facilities	Deviated from the licensed are. (Located outside the licensed area. The ownership is clear)
	Unlicensed facilities	Unlicensed. (Located outside the licensed area. The ownership is not clear).

Table 3. Facility quantity calculation method by item

Item	Facility quantity calculation method	Conversion into facility quantity
Laver farms	No. of pack × pack width × pack length	88.0㎡ per pack
Sea mustard, oyster farms	Line length × no. of line	1 line per 100m
Abalone farms	Horizontal internal diameter × vertical internal diameter × no. of cell	5.76㎡ per cell
Fish farms	Horizontal inner diameter × vertical inner diameter × no. of cell	25.0㎡ per cell

The standard for the calculation of facility quantity varies according to items as shown in Table 2. Calculation was based on [Rules on Management of Fishing Licenses, etc.], but the abalone farm quantity was calculated mostly using the farming field standard.

The facility quantity calculation method by item is shown in Table 3.

3. Results

This study confirmed the 2017 major marine product items distribution of Wando-gun as shown in Figure 2.

According to the facility quantity change by item(Figure 3), the laver farms of Wando-gun increased in both the licensed facilities and the actual facilities year on year. The actual facility quantity was 94,274 packs, up 9,824 from 2016(a). The facility quantity outside the licensed area was 52,752 packs, up 6,358 from.

The licensed sea mustard farming facility quantity decreased to 984 lines, while the actual facility quantity increased to 17,758 lines(b). The facility quantity outside the licensed area was 105,957 lines, down 4,628 from 2016 (101,329 lines).

The licensed abalone farms of Wando-gun increased in both the licensed facilities and the actual facilities. The actual facility quantity was 709,668 cells, up 30,077 from 2016(679,591 cells)(c), and the facility quantity outside the licensed area was 246,254, up 21,857, indicating a need to ensure the arrangement and

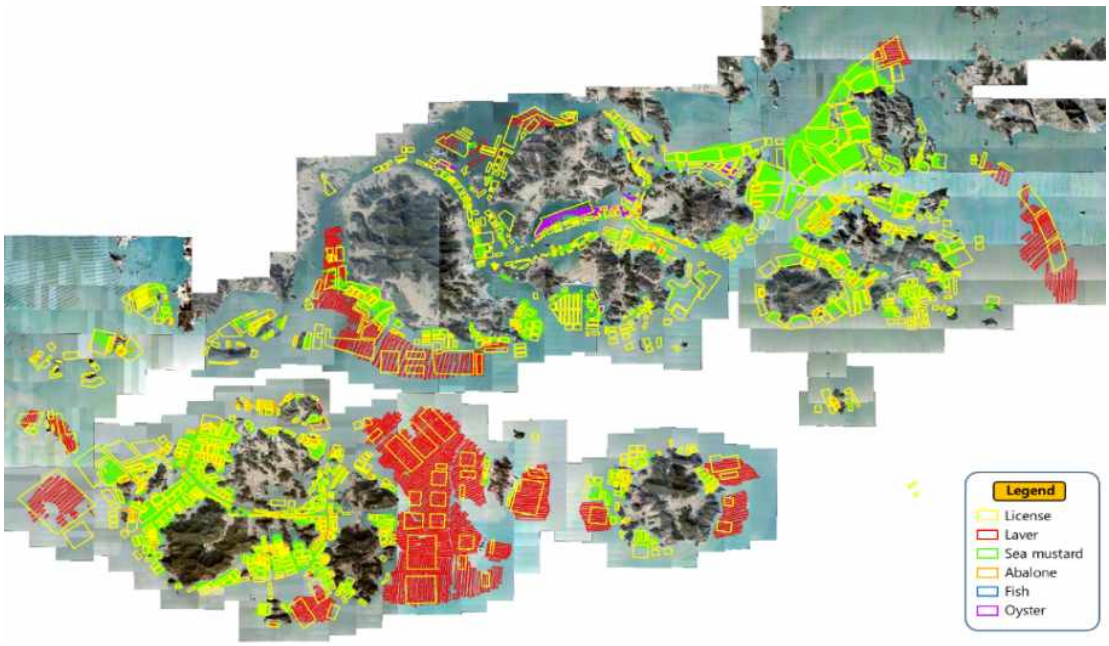
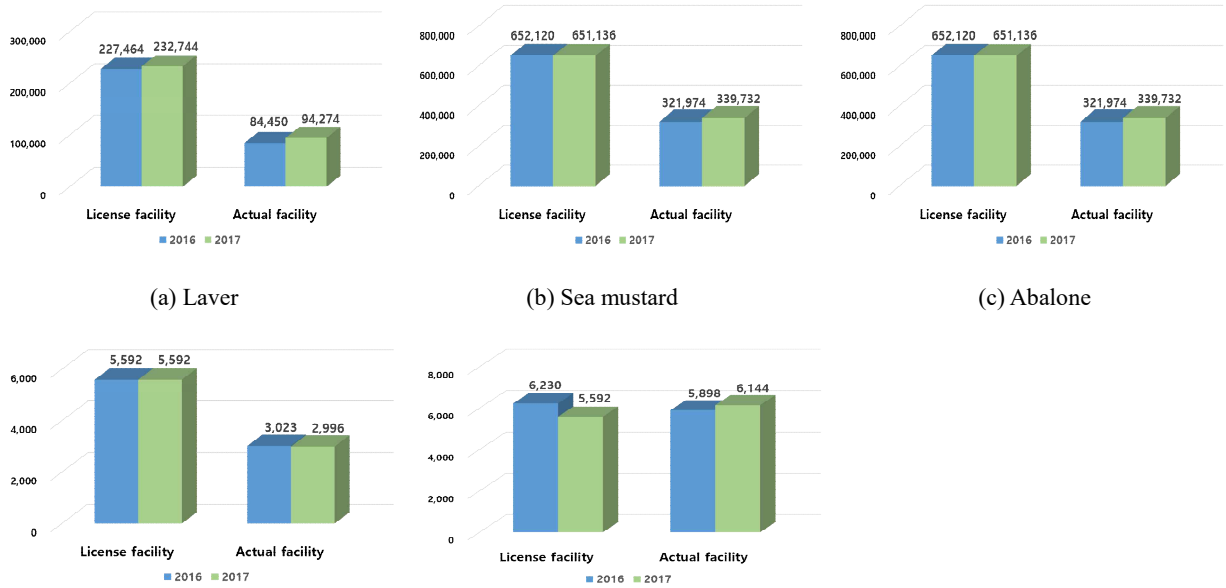


Figure 2. Major marine product items distribution of Wando-gun



(a) Laver (b) Sea mustard (c) Abalone

(d) Fish (e) Oyster

Figure 3. Marine Farm facility quantity comparison

management of the fishing grounds of this region. Further, it was found that Wando-gun, the main abalone production hub, used mostly 2.4m×2.4m facilities.

In Wando-gun, the licensed fishing farms were the same, and the actual facility quantity was 2,996, down 27 from 2016(3,023)(d). The facility quantity outside the licensed area was 447, down 32 from 2016 (479). The facility specification was mostly 6m×6m, 7m×7m.

The oyster farms of Wando-gun was decreased by 332 in terms of the licensed quantity, and the actual quantity increased by 246 lines(e). The facility quantity outside the licensed area was 3,595 lines, up 10 from 2016(3,585 lines).

4. Conclusion

This study investigated the marine farms – which are spread widely in the seas -, using the high-precision aerial images instead of the direct investigation thereof. The data can lend itself to a systematic scientific data construction for the estimation of marine product production and for the determination of the accurate facility location and facility quantity of marine farms, thus serving as the data for the management of fishing grounds and for the establishment of policies.

Reading of the farming facilities, however, can vary by marine product item depending on the aerial filming time and farming period. Thus, an additional filming by giving considerations to the facility installation period and removal period can ensure a calculation of more accurate facility quantity.

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