Transportation costs of different sizes of cantang hybrid grouper (Epinephelus fuscoguttatus ♀ x Epinephelus lanceolatus ♂) fingerlings

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Abstract. Cantang hybrid grouper (Epinephelus fuscoguttatus ♀ x Epinephelus lanceolatus ♂) fry were supplied in many regions in Indonesia through various modes of transportation. The purpose of this study was to evaluate transportation costs against cantang hybrid grouper fry size as consideration for fry users. The research was conducted at one of the grouper hatcheries in Kalianget Village, Banyuglugur District, Situbondo Regency, East Java, Indonesia in December 2019. The hybrid grouper fingerlings were used are 3.0-4.0 cm, 5.0-6.0 cm, 7.0-8.0 cm, and 9.0-10.0 cm (in total length) were transported from the nursery in Situbondo (East Java, Indonesia) to Medan (North Sumatra, Indonesia) using land and air transportation in 18-20 hours. The results showed that the highest price for grouper fingerlings to the destination was 9.0-10.0 cm of 13,050 IDR and the lowest price for fingerlings of 3.0-4.0 cm of 3,880 IDR. This data can be used as a reference for cantang grouper farmers to determine the most efficient fry size for rearing production.

1. Introduction
Cantang hybrid grouper is a grouper hybrid from the female of Epinephelus fuscoguttatus and male of Epinephelus lanceolatus in 2006 which probably increases most of the Indonesian grouper production [1–3]. Grouper hatcheries are mostly produced in certain areas that are located far from the grow-out area so that it takes a long time for transportation. The grouper industry divides into hatchery, nursery, and grow-out which are in many cases widely separated from geographical locations [3,4]. Seed transportation is an important part of the commercial marketing of fish seeds to supply aquaculture needs [5]. It takes the right transportation technique so that the seeds can live healthily and have a high survival rate to their destination.

There are two types of grouper seed transportation, namely the open system and the closed system. Open transportation systems are usually used to transport seeds over short distances and time, using water in a container that is continuously oxygenated. Closed system transportation is usually for long-distance shipments of fish seeds using plastic bags, with limited oxygen provision that has been calculated according to needs during transportation [6].
Grouper seeds that are mass-produced and continuously from hatcheries, both large and small from Bali and Situbondo, are sent to be traded for market demand in Indonesia and abroad including Singapore, Vietnam, Thailand, Taiwan, Hong Kong, and China [7,8]. These grouper seeds include the tiger grouper, cantang hybrid grouper and cantik hybrid grouper (female of *Epinephelus fuscoguttatus* x male of *Epinephelus polyphekadion*), which are produced from hatcheries and marketed around 3.0 cm in size [9,10]. The transportation distance is long and requires a long time, so most shipments use aircraft with a closed transportation system. The purpose of this study was to evaluate transportation costs against cantang hybrid grouper fry size as consideration for fry users.

2. Material and Methods

2.1. Time and place

The study was conducted in December 2019 in one of the small-scale hatcheries in Kalianget Village, Banyuglugur District, Situbondo Regency, East Java Province, Indonesia. Fingerlings of cantang hybrid grouper (*Epinephelus fuscoguttatus* ♀ × *Epinephelus lanceolatus* ♂) were transported from hatchery to Juanda Airport (Surabaya, East Java, Indonesia) by a car and from Juanda Airport to Kualanamu Airport (Medan, North Sumatera, Indonesia) by aircraft (takes about 18-20 hours).

2.2. Fish origin and collecting data

The fish used in this study were 3.0-4.0 cm, 5.0-6.0 cm, 7.0-8.0 cm, and 9.0-10.0 cm in size. Data is retrieved from three shipments. Total shipments of 70 boxes weighing 17 kg per box. Transportation costs according to size include cargo, documents, cars and tools, and packing fees.

3. Results and Discussion

The results of direct observations on transportation preparation, grouper fry selected healthy quality, with size according to demand. Fish seeds are fasted for the duration of fasting and the density of the seeds is adjusted to the size of the fish. Furthermore, the seeds are placed in buckets equipped with running water to select fish of high quality and normal performance (not defective). Furthermore, the seeds were counted by density according to size with a mortality rate of ≤ 3.0%, as shown in Table 1.

| Fingerlings size (cm) | Fasting time (hours) | Density (fish/box) |
|-----------------------|----------------------|--------------------|
| 3.0 - 4.0             | 24                   | 400                |
| 5.0 - 6.0             | 36                   | 200                |
| 7.0 - 8.0             | 48                   | 125                |
| 9.0 - 10.0            | 48                   | 100                |

Before transportation, the fish seeds have fasted so that the stomach is empty so that during transportation they do not vomit or remove metabolic waste which is excreted through feces and will accumulate in media water [11]. The decrease in water quality due to food residue and feces rot after being produced by the fingerlings during transportation, the rapid decomposition is triggered by an increase in temperature because the ice cubes in the box have melted, as a result, pH and oxygen fall, ammonia rises, these conditions can lead to fish mortality during transportation [12,13].

The method of transportation of grouper seeds was a closed system. Cantang grouper seeds are put in a double plastic bag measuring 0.08 mm thick, 120 cm long and 53 cm wide (tied at two ends so that they are rounded) then filled with 10 liters of seawater with a temperature of 26-27 °C, added pure oxygen from a tube with a ratio of water and oxygen is 1: 3 [12,14]. Furthermore, the plastic is tied with rubber and put in a Styrofoam box measuring 75 cm x 40 cm x 30 cm to prevent leakage, coated with double plastic. A total of 500 g of ice cubes wrapped in a newspaper then closed tightly using
insulation was added to maintain the internal temperature. On the outside, the Styrofoam box was wrapped again in plastic and was neatly isolated.

From the hatchery to Juanda Airport in Surabaya, it is transported using an L300 pickup, about 4 hours. Arriving at the airport before entering the aircraft, repacking (replacing oxygen) was carried out by opening and disposing of oxygen in a plastic bag, replaced by new oxygen, then repackaged as before to continue transportation by aircraft. This is to extend the time for the fish seeds to live. Lack of oxygen is the main cause of sudden and large numbers of fish deaths [15].

Transportation costs for grouper seeds in 70 boxes by aircraft from Juanda Airport to Kualanamu Airport can be seen in Table 2. Transportation costs based on the size of fish seeds can be seen in Table 3.

Table 2. Transportation costs of Cantang hybrid grouper (Epinephelus fuscoguttatus♀ × Epinephelus lanceolatus♂) by aircraft from Surabaya to Medan.

| Description                                           | Price (IDR)  |
|-------------------------------------------------------|--------------|
| Cargo fees : 70 boxes x 17 kg = 1.190 kg x IDR 34.500  | 41,055,000   |
| Quarantine and administrative documents                | 150,000      |
| Car fee                                               | 1,000,000    |
| Packing fee                                            | 7,630,000    |
| Total                                                 | 49,835,000   |
| Fee per box                                           | 711,930      |

Table 3. Transportation costs and price per fish of Cantang grouper hybrid (Epinephelus fuscoguttatus♀ × Epinephelus lanceolatus♂) in different size from Surabaya to Medan.

| Size (cm) | Density (fish/box) | Transportation fee per fish (IDR) | Price of seed at original hatchery (IDR) | Price of seeds to Medan (IDR) |
|-----------|--------------------|----------------------------------|-----------------------------------------|-------------------------------|
| 3.0 - 4.0 | 400                | 1.780                            | 2.100                                    | 3.380                         |
| 5.0 - 6.0 | 200                | 3.560                            | 3.250                                    | 6.810                         |
| 7.0 - 8.0 | 125                | 5.695                            | 4.550                                    | 10.245                        |
| 9.0 - 10.0| 100                | 7.200                            | 5.850                                    | 13.050                        |

Transportation costs have a share of 45.8 - 55.6%, so the price of seeds to their destination becomes expensive. Transportation costs for grouper sales using airplanes reach 58.4% of the selling price. Given the high cost of transportation, even in the consumption fish trade, those that are sent by plane are only groupers that are expensive, such as humpback grouper and red grouper [3]. To reduce the price, farmers buy seeds that are small in size (3.0-4.0 cm), to be maintained in the nursery until they become larger. The maintenance of grouper fry with a size of about 3.0 cm which is maintained for 45 days, produces seeds of ± 8.3 cm in size, which costs IDR 3,250 with a survival rate of 70.5% [1]. From these calculations, if the farmer buys a small size to Medan and is maintained with the same survival rate, about 8.0 cm it will cost IDR 5,030 per fish, so it is IDR 5,215 cheaper than buying a direct size of 7.0 cm via delivery as shown in Table 3.

4. Conclusion
Closed transportation systems are commonly used for grouper seed transportation by considering the travel time adjusted for the size and density of fish seeds. The cost of transportation from Surabaya to Medan is 45.8 -55.6% of the price of grouper seeds. The larger the seed size, the more expensive the transportation costs and will affect the price of grouper seeds.

5. References

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