Increasing Dissolved Oxygen in The Floating Net Cage Area of Jatiluhur Reservoir, Purwakarta

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Abstract. Dissolved oxygen is one of the important parameters in fish farming in floating net cage in reservoirs or lakes. However, dissolved oxygen will decrease due to upwelling. In this study, an aerator trial was conducted in floating net cages in reservoir. The data obtained were analyzed descriptively and statistically. The results obtained show that the aerator can increase the level of dissolved oxygen in the floating net cage area with different magnitudes from 0.05 mg/L - 1.3 mg/L especially in 4 and 5 m depths because output pipe length was 4 m for aeration.

1. Introduction
Fisheries sector especially aquaculture has become one of economic sector that supply food from fish [1, 2]. In general, aquaculture production is achieved by intensification and extensification. Intensification is carried out by increasing stocking density with the addition of aeration technology, while extensification is carried out by expanding fish farming land, including in reservoir. One of the reservoirs used as fish farming using floating net cages is the Jatiluhur reservoir [3, 4]. In order to achieve fish production target, one of strategies is supplying aeration for aquaculture, because aeration can improve water quality especially dissolved oxygen as one of the important parameters in fish farming [5, 6, 7]. Aeration can be applied for intensive aquaculture or emergency because of oxygen depletion that usually happened in floating net cage in bay, lake or reservoir [8, 9, 10].

Aerators are widely used in aquaculture is surface aerator such as paddle wheel aerator [11, 12, 13, 14, 15, 16, 17]. Unfortunately, only a few aeration that exist for aquaculture that can be applied in certain depth. This aerator is known by the name submersible aerator [18]. In this paper, we showed the result of submersible aerator trial that was conducted in floating net cages in reservoir.

2. Materials and Methods
2.1. Study site
The study was conducted at fish farmed by floating net cage in Jatiluhur reservoir that can be seen in Figure 1.

2.2. Design and trial of aerator
Aerator technology that will be tested in floating net cage was shown in Figure 2. This aerator has floating pontoon and submersible water pump and we call it as FAST. FAST stands for Floating aerator with Submersible pump Technology.

2.3. In-situ measurement
Aeration was done for 12 hours from 18.00 – 06.00 because floating net cages generally reach the minimum DO level during the mid-night or early in the morning [19]. Air from surface of floating net cage was sucked by the submersible water pump through the pipe hose to the outlet pipe along a certain depth. Every hour, the dissolved oxygen level is measured for a certain depth by using a water quality meter (YSI Professional Plus) in aerated cage and unaerated cage from 18.00 – 06.00.
3. Results and Discussion

After carrying out the immersion aerator test (FAST) for 12 hours, the dissolved oxygen (DO) measurement results for aerated and un aerated cage are shown in Figure 3. Meanwhile, to determine the effectiveness of using a submersible aeration (FAST), the dissolved oxygen (DO) data obtained was analysed by using data analysis feature of Microsoft Excel which is shown in Table 1.
Figure 3. Profile of dissolved oxygen at certain depth of floating net cage.
### Table 1. Results of t-test for two samples with assuming equal variances

| Depth (m) | Hour       | Cage with no aeration (min – max) mg/L | Cage with aeration (min – max) mg/L | p value     |
|----------|------------|----------------------------------------|------------------------------------|-------------|
| 1        | 18.00 - 06.00 | 1.47 - 3.29                             | 1.91 - 3.45                        | 0.253629    |
| 2        | 18.00 - 06.00 | 1.59 - 2.84                             | 1.8 - 3.24                         | 0.198692    |
| 3        | 18.00 - 06.00 | 1.53 - 2.76                             | 1.92 - 3.27                        | 0.288476    |
| 4        | 18.00 - 06.00 | 1.79 - 2.37                             | 2.26 - 3.26                        | **0.01427** |
| 5        | 18.00 - 06.00 | 1.11 - 2.25                             | 2.07 - 2.85                        | **0.00083** |
| 1 - 5    | 18.00 - 06.00 | 1.11 - 3.29                             | 1.8 - 3.45                         | **0.00016** |

Figure 3 showed profile of dissolved oxygen levels at certain depth in cage without aeration and with aeration for 12 hours from 18.00 to 06.00. In Figure 3(a), values of dissolved oxygen level are between 1.11 mg/L - 3.29 mg/L meanwhile in Figure 3(b), dissolved oxygen level are between 1.8 mg/L - 3.45 mg/L or dissolved oxygen level in cage with aeration was higher than in cage without aeration. It was clear that submersible aerator has ability to increase dissolved oxygen level. The value of minimum and maximum dissolved oxygen in cage with no aeration and with aeration at certain depth was shown in Table 1.

In Table 1, we also can see p value from t-test for two samples with assuming equal variances and confidence level 95%, that aeration has significant difference (p<0.05) was shown in depth 4m and 5m and also from all data from 1m – 5m. This happened because output pipe length was 4 m and it can increase dissolved oxygen at depth of 5m. This technology can be applied in floating net cage with has 2 layers of net, 1st layer of net (upper cage) until at depth 4m for carp (*Cyprinus carpio*) fish farming and second layer of net (lower cage) until at 9m depth for tilapia fish farming [20, 21, 22]

4. Conclusion

Submersible aerator with the name FAST has been proven effective in increasing dissolved oxygen levels for 12 hours from 18.00 - 06.00 especially at 4 and 5 m depths. This technology can be applied as emergency aeration for fish farming in floating net cages.

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