Aquaculture Pond Aerator Sizing (SOTR to Field Oxygen Transfer)

Oxygen demand of fish or shrimp biomass and the number of aerators, from their standard transfer rate corrected to pond temperature, saturation and oxygen level.

Method: ASCE standard-to-field oxygen transfer correction

Input parameters

Unit system: SI

Parameter	Value	Unit
Biomass in the pond	5,000.0	kg
Oxygen consumption (mg per kg per hour)	500.00	
Extra demand of pond water and sediment as a share of fish demand	50.000	%
Standard oxygen transfer of one aerator (kg per hour)	2.0000	
Oxygen saturation at pond temperature (mg/L)	7.9000	
Oxygen level to hold (mg/L)	4.0000	
Water temperature	28.000	°C
Alpha factor for pond water	90.000	%
Power of one aerator	1.5000	kW

Calculated results

Parameter	Value	Unit
Oxygen demand	3.7500	
Field oxygen transfer per aerator (kg per hour)	0.93363	
Aerators needed	5.0000	
Total aerator power	7.5000	kW

Notes for this case

• Fish and shrimp use about 300–800 mg of oxygen per kg per hour, more when warm and after feeding; the water column and sediment add more. Aerators are rated at standard conditions (clean water, 20 °C, zero oxygen, saturation 9.09 mg/L). In a pond holding C mg/L the driving force is only (C_s − C), and transfer rises 2.4 % per degree: AOTR = SOTR α (C_s − C)/9.09 × 1.024^(T−20). Night-time demand without photosynthesis sets the need.

Formula and method

$$AOTR = SOTR\,\alpha\,\frac{C_s - C}{9.09}\,1.024^{T-20}, \quad n = \frac{B\,r\,(1 + f_s)}{AOTR}$$

Variables

B	Biomass in the pond	kg
r	Oxygen consumption (mg per kg per hour)	-
f_s	Extra demand of pond water and sediment as a share of fish demand	-
$SOTR$	Standard oxygen transfer of one aerator (kg per hour)	-
C_s	Oxygen saturation at pond temperature (mg/L)	-
C	Oxygen level to hold (mg/L)	-
T	Water temperature	K
α	Alpha factor for pond water	-

P_a	Power of one aerator	W
D	Oxygen demand	-
$AOTR$	Field oxygen transfer per aerator (kg per hour)	-
n	Aerators needed	-
P	Total aerator power	W

Method and standards

Aerator sizing.

Assumptions and limits

- Steady night-time demand; uniform mixing.

References

ASCE standard-to-field oxygen transfer correction

Report details

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Release checks	3 reference cases of this calculator, computed independently, are checked on every release

Results are for engineering estimation. Verify critical designs against the referenced standards and your own data.

This calculator online

https://calc.firecad.com/civil/irrigation-farm/aquaculture-aerator-sizing

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.