Analysis of organic waste loading (total suspended solid) from shrimp culture activity in mangara bombang coastal area – South Sulawesi Province

by Alauddin Mhr

Submission date: 15-Jun-2023 12:52PM (UTC+0800)
Submission ID: 2116414723
File name: MHR_2022_IOP_Conf._Ser.__Earth_Environ._Sci._1036_012094.pdf (535.07K)
Word count: 2858
Character count: 14109

Analysis of organic waste loading (total suspended solid) from shrimp culture activity in mangara bombang coastal area – South Sulawesi Province

To cite this article: Alauddin MHR 2022 *IOP Conf. Ser.: Earth Environ. Sci.* **1036** 012094

Analysis of organic waste loading (total suspended solid) from shrimp culture activity in mangara bombang coastal area – South Sulawesi Province

Alauddin MHR[1,3]

[1]Polytechnic of Marine and Fisheries , Sidoarjo, Indonesia
[3]Corresponding Author : heryal72@gmail.com

Abstract. The aims of this research is to analysis of organic waste (Total Suspended Solid) loading from shrimp culture activity are to Intensive, Semi Intensive, dan Traditional Plus. The methods employed in the research are ; (i) field survei for shrimp culture technology and feed management applied in Mangara Bombang coastal area ; (ii) Estimated Waste Organic Loading (Total Suspended Solid) based on Using Feed. Results of analysis to intensive shrimp culture (126 shrimp/m^2), intensive shrimp culture (50 shrimp/m^2), semi intensive shrimp culture (25 shrimp/m^2), and traditional plus shrimp culture (8 shrimp/m^2) show that generated for used feed are 10.058,25 kg/hectare, 2.789,54 kg/hectare, 1.681,4 kg/hectare, and 658,67 kg/hectare. While waste organic loading (Total Suspended Solid) obtained the generated are 9228.519 kg TSS/hectare, 2387.462 kg TSS/hectare, 1155.287 kg TSS/hectare, and 487.90 kg TSS/hectare.

1. Introduction

The One of potential aquaculture that can be developed in coastal areas is shrimp farming. This shrimp farming business has developed into a food bio-industry activity which is proven to be able to generate foreign exchange for the country and also provide jobs other than as a source of animal protein [1]. Mangara Bombang District is one of the sub-districts located in the coastal area of Takalar Regency and has a fairly developed aquaculture potential, one of which is shrimp farming. Intensive shrimp farming produces organic waste mainly from feed residues, feces, and dissolved materials, which are discharged into the waters and significantly affect the quality of the coastal environment. The amount of feed input absorbs almost 60-70% of the total cost of shrimp production and is the main supplier of organic waste and nutrients to the aquatic environment [2] [3] [4] [5] [6]. [7]. The amount of feed given, about 30% is left as feed residue and 25-30% of the consumed feed will be excreted [8]. In intensive shrimp farming about 15% of the feed given will dissolve in water and 20% is returned to the environment in the form of feces [9]. Therefore, the sustainable development of shrimp ponds must pay attention to the aspects of quantification of pond organic waste produced and have the potential to cause degradation of the quality of the aquatic environment.

2. Materials and Methods

This research was conducted in the coastal area of Mangara Bombang District, Takalar Regency. The methods employed in the research are ; (i) field survei for shrimp culture technology and feed

management applied in Mangara Bombang coastal area ; (ii) Estimated Waste Organic Loading (Total Suspended Solid) based on Using Feed. Quantification of organic waste load (TSS) from shrimp farming activities is determined using the assumptions taken from the results of the study as follows : (i)The load of organic waste according to the research results of , 35% of the total feed given will be a pollutant burden either because it is not eaten (15%) or in the form of faeces (20%) ; (ii) The concentration of pond waste from leftover feed and faeces will actually decrease because it breaks down into nutrients which are then converted into phytoplankton, but in calculating the amount of waste reduction it is not taken into account, because in addition to the absence of a quantitative calculation method for that, there is also an assumption that over-predicting waste considered still better than under prediction ; (iii) Calculation of the waste load is based on the level of technology are intensive, semi-intensive, and traditional plus. Intensive technology waste calculation uses feed data from shrimp farming activities in the research location; (iv) During the first month of maintenance, water changes are generally not carried out. Water is added only to replace what is lost due to evapotranspiration. Substitution (dilution) of water in the maintenance plots is generally only carried out starting in the second month with an amount ranging from 5 % to 7% [10]. However, to simplify the calculation, the water change is considered starting from the first month. For this reason, in intensive shrimp ponds in the first two months the average water change is assumed to be 3%/day. While the water change in the three month is 10%/day and the four month is 15%. Meanwhile, in semi-intensive shrimp ponds, water changes are assumed to be 3%/day in the first month, 5%/day in the second month, and 10% in the three and four months. Based on the above assumptions, the estimation of the organic waste load in the form of TSS from shrimp farming activities entering coastal waters is determined using the following formula [11]:

1. The volume of pond water discharged on the – n day (V_{tn}) is :
$$Vt_n = (Q\%.Vtb) \quad \ldots\ldots(1)$$
2. The TSS concentration from the volume of pond water discharged into coastal waters is :
$$Cb_n = Ca_{(n-1)} \quad \ldots\ldots(2)$$
3. The addition of new water of Q% will reduce the concentration of TSS in the pond to:
$$Ce_n = Q\%.Ca_{(n-1)} \quad \ldots\ldots(3)$$
4. The increase in TSS concentration in the pond after water changes and feeding was carried out by:
$$C_{n-1} = \frac{\left[\left(Ce_{(n-1)}.Vtb\right) - \left(35\%.P_{(n-1)}.1000\right)\right]}{Vtb} \quad \ldots\ldots(4)$$

Where : C_{an} = TSS concentration in the pond before dilution (ppm)
C_e = TSS concentration in pond after dilution (ppm)
Ca(n-1) = TSS concentration in pond waste water (ppm)
P = total feed given (kg)
V_{tb} = pond water volume (m^3)
Q = percentage of pond water changes per day (%)
n = day 1,2,3.....harvest
35% = percentage of total feed that becomes pond pollutant burden (Primavera and Apud 1994)

The calculation process is as follows :

1. The first day after stocking the shrimp, then the amount of P1 was given. The amount of feed that contributes to organic waste is 35% [9] so that it will produce a TSS concentration of Ca_1, which is :
$$Ca_1 = \frac{\left((35\%.P_1).\ 1000\right)}{Vtb} \quad \ldots\ldots(5)$$

2. The second day, water changes were carried out by disposing of pond water (Vt_2) of Q % then replaced with new water so that the amount of pond water discharged into the coastal waters environment on the second day was :

$$Vt_2 = (Q\%.\ Vtb) \quad \text{.....(6)}$$

which contains a concentration of organic waste (Cb_2) of:

$$Cb_2 = Ca_1 \quad \text{.....(7)}$$

3. The addition of new water of Q% will reduce the concentration of organic waste in the form of TSS in pond water from (Ca_1) to (Ce_2) as follows:

$$Ce_2 = (Ca_1 .\ \%\ sisa\ Vtb) \quad \text{.....(8)}$$

4. After changing the water on the second day, then re-feeding the amount of P_2. The amount of feed that contributes to TSS is 35% (Primavera and Apud 1994) so that it will increase the concentration of TSS in the pond to Ca_2 by:

$$Ca_2 = \frac{[(Ce_2 + Vtb)) + (35\%.\ P_2.\ 1000)]}{Vtb} \quad \text{.....(9)}$$

5. The third day, the water is changed (as on the second day) by removing Q % of water and replacing it with new water. The water discharged around the waters contains TSS. The addition of new water will reduce the concentration of TSS in the pond from Ca_2 to Ce_3
6. After changing the water on the third day, then feeding was carried out at P_3. The amount of feed that contributes to organic waste is 35% (Primavera and Apud 1994) so that it will increase the concentration of TSS in the pond to Ca_3. This quantification process is carried out until the end of the maintenance period (harvest).
7. The total TSS waste discharged into the aquatic environment per day is:

$$TL_h = \frac{Vt_{(n)}}{1.000}\ x\ Cb_{(n)} \quad \text{.....(10)}$$

Where : Vt = volume of pond water discharged into coastal waters (m3);
Cb = concentration of TSS waste in discarded pond water (mg/l)
n = day 1,2,3,... harvest.
TL_h = amount of TSS waste discharged into coastal waters (kg/day)

3. Results and Discussion

Artificial feed given during this maintenance period is one of the triggers for the decline in the quality of the aquatic environment because not all of the feed can be utilized by shrimp and the remaining unused will become organic waste and is the cause of declining water quality [12] stated that TSS levels would be high at harvest time, especially at the volume of 20-25% of pond end waste. Therefore, it is better to use good quality feed so that pond cultivation activities become more efficient. Intensive shrimp pond organic waste load with an area of 3.750 m2 (126 fish/m^2) in the form of Total Suspended Solid (TSS) is discharged into coastal waters starting from day 1 to day 110 (end of maintenance period). The highest TSS concentration of 188,924 mg/l was found on day 61 with the amount or weight of the waste disposed of at 70,846 kg of TSS. At the end of the maintenance (harvest) period, which is the 110 day, pond drying is carried out by dumping all pond water (volume 3750 m^3) into the aquatic environment, where at the time of disposal of the entire pond water volume, the TSS concentration of shrimp ponds is 100,738 mg/l with a total volume of 100,738 mg/l. or the weight of TSS discharged into coastal waters is 377,769 kg TSS. The total amount or daily weight of TSS from day 1 – 109 is 3.082,925 kg TSS/0.375 ha. While the total amount or weight of TSS until the end of the maintenance period (harvest) was 3460,695 kg TSS/0.375 ha. Based on the calculation results above, the amount of organic waste of shrimp ponds in the form of TSS that is discharged and enters the coastal waters environment during

one growing season (MT) per unit area (ha) is 9.228,519 kg TSS/ha. Intensive shrimp ponds with an area of 4000 m^2 (50 fish/m^2) produce a load of organic waste in the form of Total Suspended Solid (TSS) which is discharged into coastal waters starting on day 1 to day 93 (end of maintenance period). The highest TSS concentration of 63,170 mg/l was found on day 61 with the amount or weight of TSS waste being disposed of at 25,268 kg of TSS. At the end of the maintenance (harvest) period, namely on the 93 day, pond drying was carried out by throwing all pond water (volume 4000 m^3) into the aquatic environment. At the time of disposal of the entire volume of pond water, the concentration of TSS waste in shrimp ponds is 44,423 mg/l with the amount or weight of TSS waste discharged into coastal waters of 177,692 kg TSS. The total amount or daily weight of TSS waste from days 1 – 92 is 777,293 kg TSS/0.4 ha. While the total amount or weight of TSS waste until the end of the maintenance period (harvest) was 954,985 kg TSS/0.4 ha. Based on the calculation results above, the amount of organic waste of shrimp ponds in the form of TSS that is discharged and enters the coastal waters environment during one growing season (MT) per unit area (ha) is 2387,462 kg TSS/ha. In semi-intensive shrimp ponds with an area of 5000 m^2 (25 fish/m^2) it produces a load of organic waste in the form of Total Suspended Solid (TSS) which is discharged into coastal waters starting on day 1 to day 95 (end of maintenance period). The highest TSS concentration of 28,818 mg/l was found on day 61 with the amount or weight of TSS waste being disposed of at 11,527 kg of TSS. At the end of the maintenance (harvest) period, namely on the 95 day, pond drying was carried out by dumping all pond water (volume 5000 m^3) into the aquatic environment. At the time of disposal of the entire volume of pond water, the concentration of TSS waste in shrimp ponds is 21,552 mg/l with the amount or weight of TSS waste discharged into coastal waters of 107,761 kg TSS. The total amount or daily weight of TSS waste from days 1 – 94 is 469,883 kg TSS/0.5 ha. While the total amount or weight of TSS waste until the end of the maintenance period (harvest) was 577,644 kg TSS/0.5 ha. Based on the calculation results above, the amount of organic waste from shrimp ponds in the form of TSS that is discharged and enters the coastal waters environment during one growing season (MT) per unit area (ha) is 1.155,287 kg TSS/ha.Traditional plus shrimp ponds (8 tails /m^2) produce a load of organic waste in the form of Total Suspended Solid (TSS) which is discharged into coastal waters of 487,90 kg TSS/ha. TSS waste in shrimp ponds is intensive (126 fish/m^2), intensive (50 fish/m^2), semi-intensive (25 fish/m^2), and traditional plus (8 fish/m^2) can be seen in table 1.

Table 1. Shrimp pond organic waste in the form of TSS based on the level of technology in the coastal area of Mangara Bombang District

Shrimp Farming Technology Level	Organic waste in the form of TSS (kg/ha/MT)
Intensive shrimp culture (126 seeds /m^2)	9.228,519 kg TSS/ha/MT
Intensive shrimp cultute (50 seeds/m^2)	2.387,462 kg TSS/ha/MT
Semi intensive shrimp culture (25 seeds/m^2)	1.155,287 kg TSS/ha/MT
Traditional plus shrimp culture (8 seeds/m^2)	487,90 kg TSS/ha/MT

Source : Analysis of Data (2008)

Conclusion

Intensive shrimp pond cultivation activities with stocking of 126 fish/m^2 produce TSS waste of 9228,519 kg TSS/ha/MT. Intensive shrimp pond cultivation activities with stocking of 50 fish/m^2 produces TSS waste of 2387,462 kg TSS/ha/MT. Semi-intensive shrimp cultivation activities with stocking of 25 tails /m^2 produces TSS waste of 1155,287 kg TSS/ha/MT. Traditional shrimp ponds cultivation activities with stocking of 8 seeds/m^2 produce TSS waste of 487.90 kg TSS/ha/MT.

References

[1] Rukyani A. 2001. Kebijakan penerapan teknologi budidaya udang windu yang bertanggungjawab. Pusat Riset Perikanan Budidaya-Departemen Kelautan dan Perikanan. Jakarta. Hal 35 – 54.
[2] Barg UC. 1992. Guidelines for the promotion of environmental management of coastal aquaculture development. FAO Fisheries Technical Paper 328, FAO, Rome. 122p.
[3] Phillips MJ, Clarke R, Mowat A. Aquacultural Engineering 12 (1993):47-54
[4] Kibria G, Nugegoda D,Lam P, Fairclough R. 1996. ICLARM Quarterly, July 1996,p:20-24.
[5] Boyd CE. 1988. Water quality in warmwater fish ponds. Fourth Printing. Autburn University Agricultural Experiment Station. Alabama. USA. 359 p.
[6] Boyd CE. 1995. Bottom soils, sediment, and pond aquaculture. Chapman and Hall, New York. 348 pp.
[7] Siddiqui AQ, Al-Harbi AH. 1999. Aquaculture 17:245-252
[8] McDonald, Tikkanen ME, Axler CA, Larsen RP, CP and Host G.1996. Aqua eng, 15 (4) : 243 – 259.
[9] Primavera JH, Apud FF. 1994. Philip. J.Fish., 18 (5) : 142 – 176.
[10] Widigdo B, Kadarwan S. 2002. Rumusan kriteria ekobiologis untuk menentukan potensi alami kawasan pesisir untuk budidaya tambak. Diktat Bahan Kuliah Pengembangan Perikanan Kawasan Pesisir dan Laut. Institut Pertanian Bogor. 32 Hal.
[11] WidigdoB, Pariwono. 2003. *J Ilmu-ilmu Perairan dan Perikanan Indonesia* 1, 10-17.
[12] Horowitz A, Horowitz S. 2000. The Advocate, Vol. 3 , Issue 2 , April 2000, p; 33 – 34.

Analysis of organic waste loading (total suspended solid) from shrimp culture activity in mangara bombang coastal area – South Sulawesi Province

ORIGINALITY REPORT

10%	8%	4%	2%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	Submitted to East Carolina University Student Paper	2%
2	journal.trunojoyo.ac.id Internet Source	2%
3	fsd.unsyiah.ac.id Internet Source	1%
4	Chunlong Wang, Hongwei Guo, Rongqiang Liu, Hui Yang, Zongquan Deng. "A programmable origami-inspired webbed gripper", Smart Materials and Structures, 2021 Publication	1%
5	jglobal.jst.go.jp Internet Source	1%
6	rp2u.unsyiah.ac.id Internet Source	1%
7	Akhmad Mustafa, Hasnawi Hasnawi, Andi Indra Jaya Asaad, Mudian Paena. "Characteristics, suitability and	1%

recommendations for management of land in acid sulfate soil-affected brackishwater ponds for tiger prawn (Penaeus monodon) culture in Luwu Regency, Indonesia", Journal of Coastal Conservation, 2014
Publication

8	archive.org Internet Source	<1%
9	repository.seafdec.org.ph Internet Source	<1%
10	repository.ub.ac.id Internet Source	<1%
11	www.eri.u-tokyo.ac.jp Internet Source	<1%

Exclude quotes	On	Exclude matches	Off
Exclude bibliography	On		