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EFFECT OF DIFFERENT STOCKING DENSITIES ON SURVIVAL RATES OF NILE TILAPIA FINGERLINGS TRANSPORTED IN PLASTIC BAGS

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ABSTRACT: Fish farmers in Sudan obtain their seed stocks mainly not from their farms and as such rely heavily on good packing conditions covering sometimes 8–12 hours transportation time to maximize fish survival and quality the study here required main objective to identified the optimum loading for the success during transporting. closed oxygenated plastic bag which was carried three densities for each one with tow replicate for every treatment for the lower loading is 75 fingerlings /l the medium is, 100 fingerlings and last density is the larger one 140 fingerlings the duration factors was 10 hours, 11 hours and 18 hours. The fingerlings was sex reversed, their size is (5g ± 0.5). The collecting data analyze used SPSS computer software version- 16.0. Analysis result shown the factor of density in the tow treatments (75 fingerlings + 100 fingerlings) was the best according to the survivor rate depending to type of the periods parameter. 10 hour=94% and 11 hours = 92% and here was N.S otherwise the comparative between those and the density 140 was high significant. Variation between loading and durations is NS at P<0.05, so the conclusions is found the optimum loading during transporting period was 100/l/18 (hundred fish per litter in 18 hours period) according to analysis details.

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INTRODUCTION

According to international food policy research institute prediction the global fish consumption will increase to 127.8 million tons in 2020. Seventy seven percent of this amount will be consumed by developing countries while the developed countries will consume the rest. In the coming 20 years the mean global fish consumption per capita will increase by 0.4%, but the rate for China and India will be higher at 1.3% and 0.9% respectively. The rate for Latin America and Southeast Asia will be 0.4% and 0.5% respectively while the rate for other countries will be low or even negative FAO (2012).

Aquaculture is now recognized as a viable and profitable enterprise. Worldwide fish supply can be controlled more effectively when fish are cultured under managed conditions like domestic livestock FAO (2012). Aquaculture production has been expanding rapidly in recent decades especially in developing countries due to growing demand for high quality protein from aquatic sources. This expansion has contributed in some instances to local food security World Fish Center (2012).

Sudan`s fisheries resources depend mainly on the White Nile, the Blue Nile, the main River Nile and their tributaries and huge number of small water bodies of fresh water including reservoirs, lakes, small ponds, canals, irrigation canals. The estimated annual sustainable potential is (100,000~110,000 (mL/t/y) while actual annual production is 50,000m./t/y. and the annual consumption rate per individual is about (1.5 kg/p/y). Many fish species were studied and tested for aquaculture in Sudan. Tilapia was found to be the most appropriate one for the following reasons. It grows well at high densities, it is resistant to diseases and it has simple hatchery technology. The contribution of fisheries to the Sudan economy is presently marginal and is mostly obtained by capture fish landings. The magnitude and trend of fish resource utilization and the level of development of the fisheries sector is handicapped by as number of problems and constraints. Some of the reasons are that, no attention has been paid to the development the fisheries sector and aquaculture is only playing a marginal role, despite the availability of its basic prerequisites FAO (2012).

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Transporting fish is very important part of fish culture. Fry and fingerlings must be transported from hatchery to pond for stocking and brood fish are sometimes transported in to the hatchery to spawn. It may even be necessary to transport live harvested fish to transport market for sale. A fish farmer must be very familiar with the principles, techniques and practices of fish transportation so as to minimize fish death resulting from transportation I.C.A. (1990).

Fish are generally transported in containers such as cans of different sizes, pots of ceramic or metal, wooden or metal buckets, vats, barrels, plastic bags, Styrofoam boxes, bottles, jugs etc. Generally, almost any clean, water proof container may be used. Certain containers like wood and Styrofoam are good heat insulators while metal or plastic containers are poor insulators and may have to be wrapped with wet towels or packed with ice to keep temperatures down (ICA, 1990). Once fish have been placed in transport containers they should be brought to their destination by the quickest possible means. That will provide relatively smooth and direct route which may be made by foot, animal cart, bicycle, boat, vehicle etc.

MATERIAL AND METHODS

Small digital balance 0.00-20.00 g (electronic scales, produced by AND Company), Different types of thermometers (produced by Big Learning Company), Oxygen cylinders from liquid air Company. Cartons size 100 cm x 50 cm x 80 cm. Scope nets size 30 cm diameter. One metal barrel filled water on truck. One Plastic container. One Truck or open Box car Hilux. Treatment and handling tools (light source, gloves, boxes) .Safety and protection tools. Two note books. Ninety Plastic bags. One cell phone Stop watch. One five liters Plastic container.

The experimental design comprises one thousand and ninety fingerlings divided among 18 plastic bags. Two variables were used in the experiment and these were the loading and the transporting period. Three different loadings were used and these were 140, 100 and 75 fish per liter. The transporting periods were set at 10, 11 and 18 hours. Two replicas were made of each of these variables. Fish feeding ceased 24 hours prior to the time of their transportation. The fish were placed in bags in which water constitutes one quarter and the three remaining quarters contain oxygen. After adding oxygen the bag is sealed shut with a rubber band then agitated by pure oxygen of liquid air 99% they fish were then transported from Khartoum north to Barber in the River Nile state which is located 324 kilometers north. The average air temperature during the journey was 24 C while the average water temperature was 18 ºC. Wet clothes placed over the bags will keep them cool, and immediately upon arrival the rates of mortality and survival were determined.

Statistical analysis

The statistical analysis of the data was conducted using SPSS statistical package Ver.16

RESULTS AND DISCUSSION

Measurements and Readings

The number of dead fish were recorded after 10 hours were 39 dead fish in loading 140 per litter while were 21dead fish in loading 100 per litter and only 8 dead fish were sorted from this group . The total of mortality in the short period was 68 dead fish, the number of dead fish were recorded after 11 hours were 46 dead fish in loading 140 per litter while were 23 dead fish in loading 100 per litter and only 9 dead fish were sorted from this group . The total of mortality in the medium period was 78 dead fish. The number of dead fish were recorded after 18 hours were 55 dead fish in loading 140 per litter while were 30 dead fish in loading 100 per litter and only 18 dead fish were sorted from this group . The total of mortality in the long period was 103 dead fish.

Table 1- The mortality loading 140/liter according to different duration in experiment.

Density	Duration	Mortality	Mortality Rate	Survivor%
140	10	17	12.14%	87.86%
140	10	22	15.70%	84.30%
140	11	24	17.14%	82.86%
140	11	22	15.70%	80.70%
140	18	27	19.30%	80.70%
140	18	28	20%	80%

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Table 2 - The Mortality loading 100/liter According To Different Duration in Experiment

Density	Duration	Mortality	mortality rate	Survival %
100	10	10	10%	90%
100	10	11	11%	89%
100	11	11	11%	89%
100	11	12	12%	88%
100	18	16	16%	84%
100	18	14	14.00%	86%

Table 3 - The Mortality loading 75/liter According To Different Duration In Experiment

Density	Duration	Mortality	Mortality Rate	Survival %
75	10	2	2.70%	97.30%
75	10	6	8%	92%
75	11	3	4%	96%
75	11	6	8%	92%
75	18	9	12%	88%
75	18	9	12%	88%

Table 4 - Show the stocking densities throughout different periods of time

Factors		Parameters		
		Transport duration	Mortality	Survival Number
Packing density	140 fingerlings	10 hours	19.50±3.54	120.50±3.54
		11 hours	23±1.41	117±1.41
		18 hours	27.50±0.71	112.50±0.71
	100 fingerlings	10 hours	10.50±0.71	89.50±0.71
		11 hours	11.50±0.71	88.50±0.71
		18 hours	15±1.41	85±1.41
	75 fingerlings	10 hours	4±2.83	71±2.83
		11 hours	4.50±2.12	70.50±2.12
		18 hours	9±0	66±0
Main effect				
Packing density		140 fingerlings	23.33a	116.67a
		100 fingerlings	12.33b	87.67b
		75 fingerlings	5.83c	69.17c
Standard error			0.75	0.75
Significant			**	**
Transport duration		10 hours	11.33a	93.67a
		11 hours	13.00b	92a
		18 hours	17.17a	87.83b
Standard error		–	0.75	0.75
Significant		–	**	**
Significant		NS	NS	NS

N=2; Different superscript letters in the same column means significant difference at P<0.05; **: significant difference at P<0.05; NS: No significant difference

First factor is 10 hours transporting period

The density in this period was found to be 140/l and the mean mortality equals 19.50±3.54 which constitutes 13.92 per cent:

Second density in this period 100/l mean of mortality equals 10.50±0.71 as percentage equals 11%.

Last density capacity in this period was 75/l the mean of mortality equals 4±2.83 fish and as percentage equals 5.35%.

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Second factor is 11 hours transporting period

- First density in this period was 140 /l the mean of mortality = 23±1.41 and as percentage equals16.42%.
- Second density in this period 100 /l mean of mortality = 11.50±0.71 as percentage equal = 12%.
- Last density capacity in this period was 75/l the mean of mortality = 4.50±2.12 fish.as percentage equal 6%.
- Third factor is 18 hours trip period.
- First density in this period was 140 /l the mean of mortality = 27.50±0.71 as percentage equal 19.65%.
- Second density in this period 100 /l mean of mortality = 15±1.41 as percentage equal = 15%
- Last density capacity in this period was 75/l the mean of mortality = 9±0 fish. as percentage equal 24%
- The results of the statistical analysis comparing the survival rates indicated that the mean survival rate is not significantly different between the two densities of 100 fingerlings per liter and 75 fingerlings per liter. They were found to be 93.67% and 92.0% respectively while the survival rate at 140 /l was found to be 87.3% which is significantly different at $P < 0.05$.

DISCUSSION

Fish farmers in Sudan obtain their seed stocks mainly not from their farms and as such rely heavily on good packing conditions covering sometimes 8–12 hours transportation time to maximize fish survival and quality. The transportation of live fish involves the transfer of large numbers (or biomass) of fish in a small volume of water. The Sudan climatic conditions are characterized by high temperatures during most of the months of the year. As a result the oxygen consumption is higher in transporting fish which necessitates the use the closed plastic bags in which oxygen supply is controlled. NAPFRE (2011) recommended that the water in the plastic bags should frequently be replaced with fresher supply so that adequate oxygen is provided and the fish waste excretions were disposed of. These recommendations should be followed specially during long transporting periods and higher temperatures. In this study though the water holing the fish in the plastic bags had not been changed, the survival rate of the fish was generally high. This could be attributed to the average low temperatures which were 18 and 24 for water and air respectively. The highest stocking density of 140 /l showed a lower survival rate equals to 87 %. However, the survival rate is not significantly different $P>0.05$ between the densities of 75/l and 100 /l which they were 92% and 93% respectively. In this study it was found that the density of 100/L produced the highest loading in the transporting time with lowest risk. In different research and studies recommendations were in the same range of 90-120 fingerlings size (5.03 cm) (NAPFRE, 2011).

The results of this thesis indicated that the range of loading of fingerlings in Sudan varies between 75 and 100 fingerlings/liter. This showed a higher survival rate and it was more successful than 140 fingerlings /l. Fish stress was not observed in my lowest loading of 75 fingerlings per litter. Monica *et al.* (2011) observed that signs of stress were exhibited within four hours for Piau (*Leporinus friderici*) during transporting but the difference could be attributed to the specific differences and Water temperature which increased throughout the transportation (from 20.8±0.34 to 24.2±0.12 °C; $P<0.0001$). In this study the maximum and minimum water temperatures were 19°C and to 17°C respectively. In future we shall need only to explore the other factors affecting fingerlings transport like economical, the distance travelled and the type of transporting.

CONCLUSION

Provision of fingerlings constitutes the basis of fish culture in Sudan. The results of data analysis showed that density and transporting periods are the most important factors that affect the existence and the survival of the fingerlings.

At a fixed transporting time there was no significant difference in the survival rate between the stocking densities of 75 and 100 fingerlings per liter. However, the stocking density of140 fingerlings per liter showed significantly lower survival rate. So to implement the optimum densities in transporting fingerlings the stocking density of 75-100 fingerlings per liter per 18 hours should be used. In cases when the distance or the time spent in transporting is be less than 10 hours we can increase the stocking density to 140 fingerlings per liter of water. But only 100 grams/liter/18 hours can be recommended as an optimum stocking density which can be used to transport Tilapia fingerlings in Sudan.

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