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# The effect of various salinity levels and stocking density manipulation methods on the survival of milkfish fry (*Chanos chanos* Forsskal) during storage

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The milkfish fry industry has long been existing in the Philippines. Fry dealers from different parts of the country have developed their own techniques of storing and feeding fry before they are sold to fishpond owners. Consequently, different methods in the manipulation of stocking density during storage are now being employed; feeding has never been standardized and the salinity of the water suitable for storing fry has not been determined. Antonio and Manacop (1956) obtained a survival of 99.0% of fry stored for two weeks in freshwater and a survival of 83.3% for 11 days in seawater. The common practice, however, is to store fry in water with low salinity (approximately 18-20 ppt). Generally, mortalities ranging from 3% to 10% (personal interviews) occur during the period of storage which would last for, at most, two weeks. It is not known, however, what causes the mortality. This may be due to stress because of improper handling during collection, sorting, counting and transport (Blanco and Villadolid, 1939; Carbine, 1948; Antonio and Manacop, 1956; PCARR, 1976); overcrowding and unfavorable water conditions (Antonio and Manacop, 1956), or even to insufficient and unsuitable feed (Ronquillo and Villameter, 1957).

To date, there is no standardized method of storing milkfish fry, although there are a number of publications describing the different practices of the fry industry concerning collection, transport and storage (Blanco and Villadolid, 1939; Carbine, 1948; Mane *et al.,* 1952; Villaluz, 1953; PCARR, 1976; Librero *et al.,* 1976 a and b; and Smith, 1978). Consequently, a study has been conducted with the ultimate objective of developing and standardizing a method of storing milkfish fry such that mortality is very much reduced. Specifically the study aims to determine the effect of various salinity levels and stocking density manipulation methods on the survival of milkfish fry during storage.

The fry used in the experiment were bought from one fry concessionaire at Hamtik, Antique. These have been stored for two to three days without feeding. Upon arrival, the fry were counted while predators and other accompanying species were sorted out. To avoid stress, the salinity of the original water was gradually changed to the desired salinities. The fry were acclimated to the experimental set-up for one day. The fishes had an initial mean total length of $13.65 \pm 0.73$ mm and initial mean wet weight of $6.98 \pm 2.40$ mg.

In this study, white plastic basins having 11.4 cm depth and 29.2 cm inside diameter were used for fry storage. To follow closely the practices of fry dealers, the containers were not provided with aeration. The containers, covered with wooden slats, were placed on top of each other to save space. This arrangement provides free exchange of air in between containers.

The different salinity levels used were: 8 ppt; 16 ppt; and 32 ppt, while the different stocking density manipulation methods were the following:

I. The same stocking density was maintained during the whole storage period.

| Day | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 366 fry/L | | | | | | | | | | | | | |

II. The fry in every container were divided equally into two groups after three days of storage and the stocking density of 183 fry/L was maintained until the end of the storage period.

| Day | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 366 fry/L | | | 183 fry/L | | | | | | | | | | |
| | | | | 183 fry/L | | | | | | | | | | |

III. The number of fry in every container was divided equally into two groups after every three days within the first 10 days and the volume of water was adjusted to attain the right stocking density per unit volume; thereafter, the new stocking density was maintained till the end of the storage period.

| Day | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 336 fry/L | | | 183 fry/L | | | 91.5 fry/L | | | 45.75 fry/L | | | | |
| | | | | | | | 91.5 fry/L | | | 45.75 fry/L | | | | |
| | | | | | | | 91.5 fry/L | | | 45.75 fry/L | | | | |
| | | | | | | | 91.5 fry/L | | | 45.75 fry/L | | | | |
| | | | | 183 fry/L | | | 91.5 fry/L | | | 45.75 fry/L | | | | |
| | | | | | | | 91.5 fry/L | | | 45.75 fry/L | | | | |
| | | | | | | | 91.5 fry/L | | | 45.75 fry/L | | | | |
| | | | | | | | 91.5 fry/L | | | 45.75 fry/L | | | | |

The fry were fed once a day with hard-boiled chicken egg yolk blended with water to impart a milky consistency (6 g of hard-boiled egg yolk per 100 mL of freshwater). For every 6,000 fry, 45 mL of freshly prepared feed were given.

Approximately 3/4 of the water was changed every morning. All the feces, excess feed and dead fry were removed to prevent deterioration of water quality. Mortality was recorded twice a day.

The daily mean percentage survival, level of dissolved oxygen and pH values of the different treatments are illustrated in Figs. 1-3. Results of this study indicate that survival rate and increase

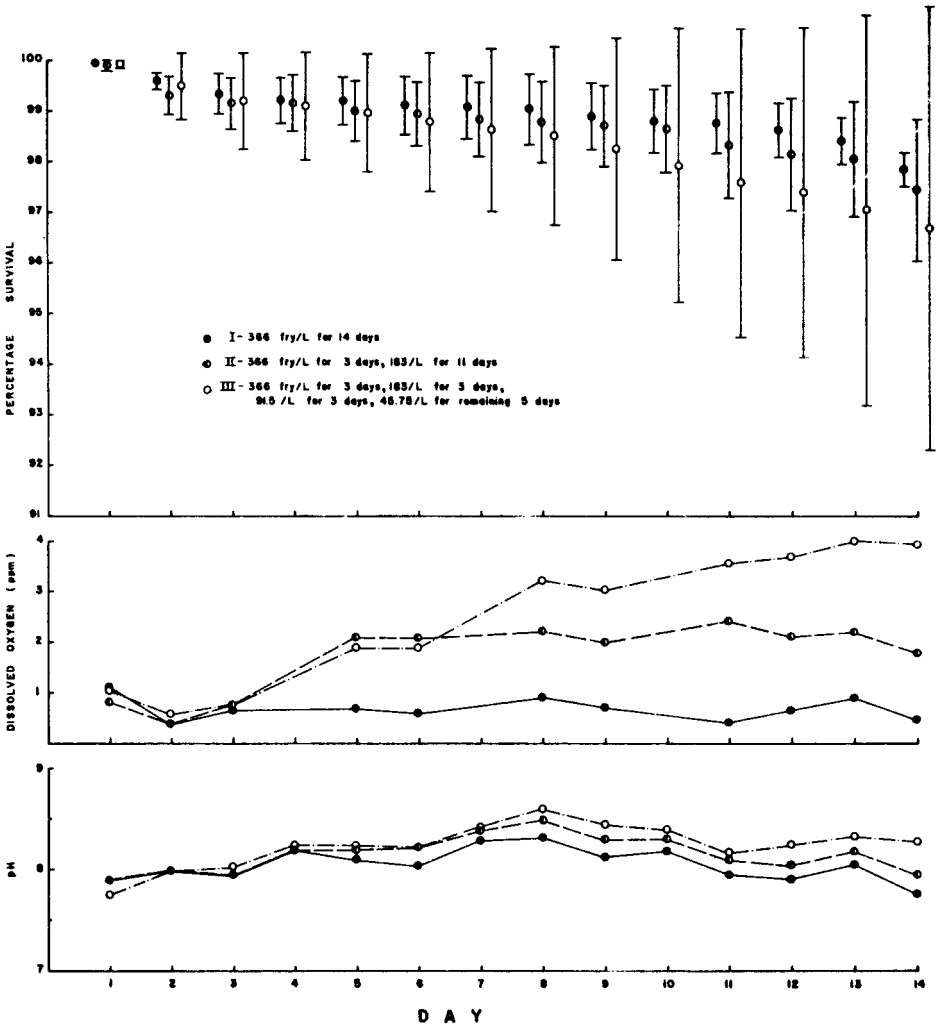


**Fig. 1. Daily mean percentage survival, level of dissolved oxygen and pH of the different stocking density manipulation methods at 8 ppt salinity level.**

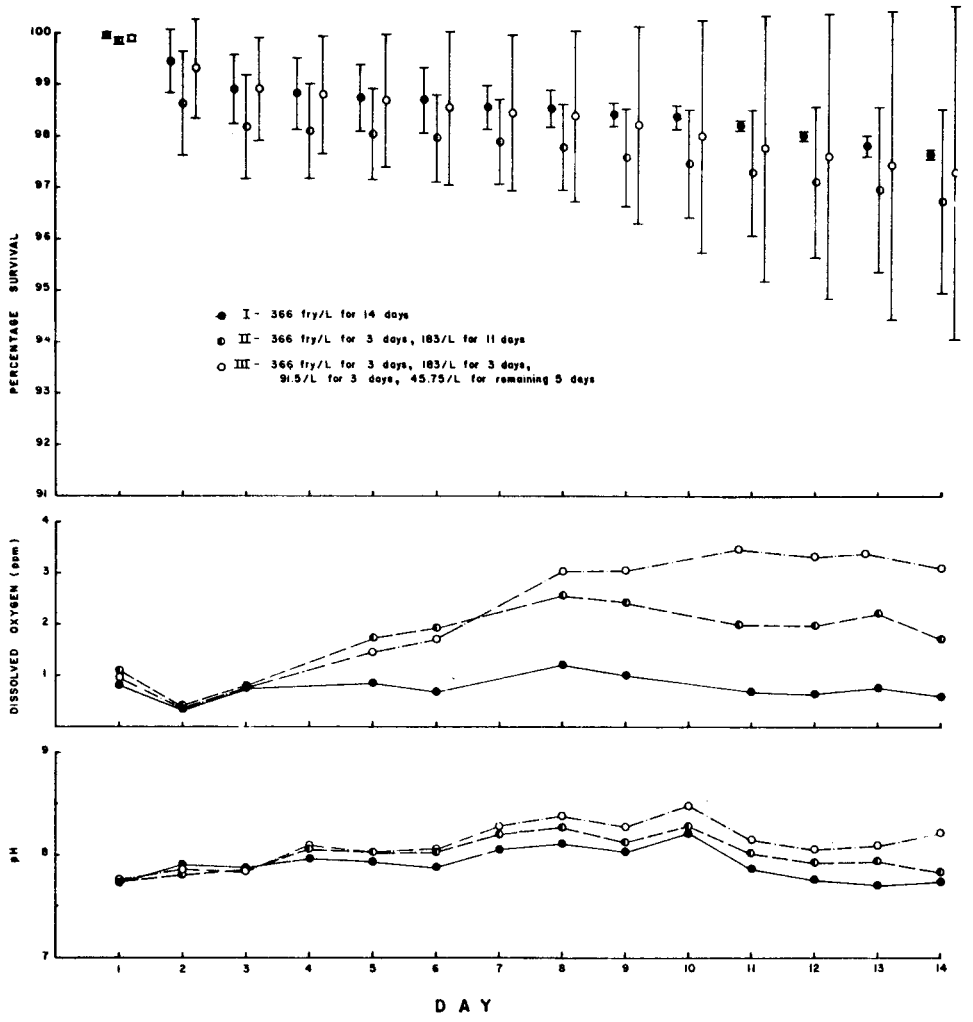


**Fig. 2. Daily mean percentage survival, level of dissolved oxygen and pH of the different stocking density manipulation methods at 16 ppt salinity level.**

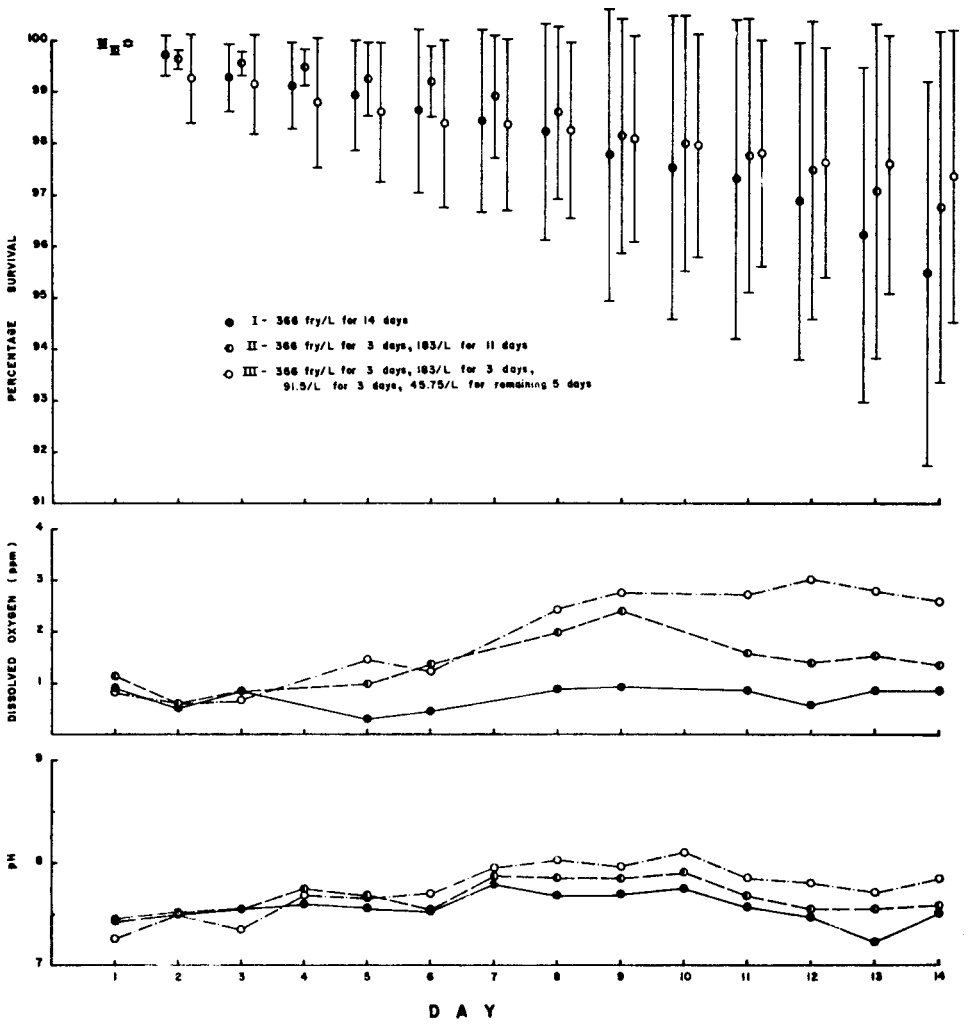


**Fig. 3. Daily mean percentage survival, level of dissolved oxygen and pH of the different stocking density manipulation methods at 32 ppt salinity level.**

in body weight did not differ significantly ($P>.05$) at different salinity levels or at different stocking denstiy manipulation methods. Moreover, a significant interaction between salinity and stocking density manipulation method could not be statistically demonstrated. The highest survival rate was 97.8% at stocking density manipulation I with 8 ppt while the lowest was 95.5% also at stocking density manipulation I with 32 ppt. Increase in length, however, differed significantly ($P<.05$) at different salinity levels; in addition, a significant interaction could be statistically demonstrated. Increase in length was fastest at: a) stocking density manipulation I at 16 ppt; b) stocking density manipulation II at 8, 16 or 32 ppt; and c) stocking density manipulation III at 8 or 16 ppt.

From the results of this study, it is evident that there is no need to reduce the salinity of the water used in storing milkfish fry in order to attain higher survival as commonly believed. Sufficient food and maintenance of good water quality are more important than salinity for higher survival of fry during storage.

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