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Survival and growth of juvenile silver pompano *Trachinotus blochii* (Lacepède, 1801) at different salinities in tropical conditions

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ABSTRACT

The objectives of the present study were to evaluate the tolerance of juvenile silver pompano to different salinity conditions in order to determine the minimum salinity required for survival and also to study the effect of different salinities on survival and growth. Wild caught juveniles of the silver pompano *Trachinotus blochii* (average initial length: 4.38±0.44 cm, average initial weight: 1.6±0.09 g) were used in the experiments. The experiments were conducted in triplicate with 15 fish per tank. Control groups were maintained at 34±1 ppt. Juvenile silver pompano reared at ambient salinity (34±1ppt) were transferred directly to lower salinities (25, 15, 10, 5, 4, 3 and 1 ppt) and monitored for survival. Results indicated that the minimum salinity required for the survival of juvenile *T. blochii* is 4 ppt and 100% mortality was observed within 7-8 h in 1 ppt salinity. In another experiment, three salinity reduction protocols were followed and the three treatment groups were exposed to 25, 15 and 5 ppt salinity for a period of 56 days and the growth and survival were monitored. Survival and growth in terms of weight was not significantly different in the treatments from the control group except in the case of 5 ppt, which showed comparatively lower survival and specific growth rate (SGR). The results indicate that the culture of juvenile pompano might be feasible in salinities up to 15 ppt in tropical conditions.

Keywords: Euryhaline, Salinity tolerance, Silver pompano, *Trachinotus blochii*

Introduction

The silver pompano *Trachinotus blochii* is a euryhaline, pelagic, active swimming, omnivorous fish with good meat quality. It is comparatively easy to domesticate and breed under controlled conditions. The species is ideal for mariculture because of its fast growth rate and easy weaning to pellet feeds. Silver pompano larvae, fingerlings and adult are hardy and can be easily acclimatised to lower salinities. Sampaio *et al.* (2003) found that pompano tolerate wide range of salinity, between 7 and 58 ppt on acute exposure of individuals acclimated to seawater (35 ppt), and on gradual exposure to diluted seawater with even lower salinities. The objectives of the present study were to evaluate the salinity tolerance of juvenile pompano exposed to various salinity conditions in order to determine the minimum salinity required for survival and also to study the effect of different salinities on survival and growth.

Materials and methods

Juveniles of *Trachinotus blochii* caught from the sea off Mandapam in Tamil Nadu were used for the experiments. Experiments were conducted in triplicate in 30 l tanks with 15 juveniles (average initial length: 4.38±0.44 cm, average initial weight: 1.6±0.09 g) per tank. Control groups were maintained at 34±1 ppt.

Two sets of experiments were conducted. In the first experiment, juvenile silver pompano reared at ambient salinity (34±1 ppt) were transferred directly to lower salinities (25, 15, 10, 5, 4, 3 and 1 ppt) and monitored continuously. They were fed twice a day at 06.00 hrs and 16.00 hrs. The number of survivors in each test salinity were recorded at time intervals of 4, 8, 12, 16, 20, 24, 48 and 72 h.

In the second set of experiment, three salinity reduction protocols were followed. In the first set, salinity was reduced from 34±1 ppt by 10 ppt every two days up to 25 ppt (T_1). In the second set, salinity was reduced by 5 ppt every two days up to 15 ppt (T_2). In the third set, salinity was reduced by 5 ppt every two days up to 5 ppt (T_3). Fishes were fed *ad libitum* twice daily with artificial diet (INVE-NRD feed, Thailand) of appropriate pellet size. Uneaten feed and fecal matter were removed periodically. Dead fishes, if any, were removed and recorded. Fish from each tank were counted and weighed every week (7^{th} day) until the end of 56 days to monitor survival and growth.

Percentage survival (%) was determined as: Number of survivors at the end of the experiment × 100/ number stocked initially. Specific growth rate (SGR) was determined as: SGR (% body weight day^{-1}) = [(ln ($W_2 - W_1$)) x 100]/Δt, where, W_1 = initial wet weight of fish at stocking, W_2 = final wet weight of fish, t = growout period.

Water exchange (50%) was done daily and care was taken to maintain the treatment salinity with reverse osmosis water. Multi-parameter kit (Eutech instruments – PCD 650 model) was used for measuring the water quality parameters in the rearing tanks. Temperature ranged from 28 ^{0}C to 31 ^{0}C, pH ranged from 7.5 to 8.23 and dissolved oxygen (DO) ranged from 4.51 to 6.34 mg l^{-1} in the rearing tanks.

Statistical analysis

The data were analysed using SPSS version 16.0, using one-way ANOVA and Duncan's multiple range test was carried out for post hoc comparison of mean. A significance level of $p<0.05$ was used.

Results and discussion

The results of the first experiment indicated that the minimum salinity required for survival of juvenile *T. blochii* is 4 ppt. Mortality (100%) was observed in 3 ppt salinity within 10-12 h of the experiment. In 1 ppt salinity, 100% mortality was observed within 7-8 h (Fig. 1).

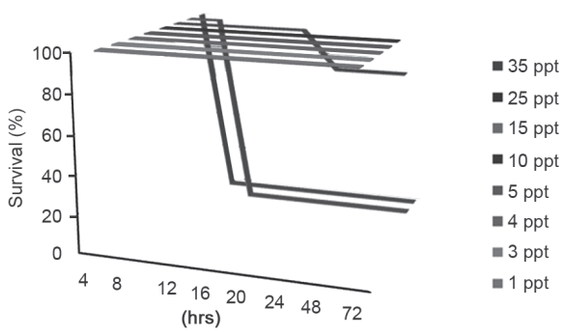

Fig. 1. Percentage survival of juvenile pompano in different salinities within 72 h

In the second experiment, survival rate was not significantly different among different treatments throughout the experiment, except in T-3 (5 ppt) which showed lower survival than the control fishes (Fig. 2). The growth in terms of weight gain (Fig. 3) was not significantly different between the treatment and control groups and SGR was lower in the 5 ppt treatment when compared to other groups (Table 1).

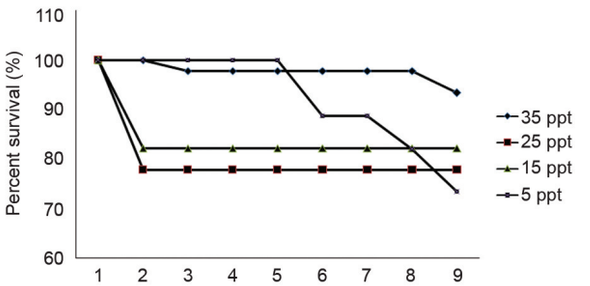

Fig. 2. Total survival (%) of juvenile pompano at different salinities

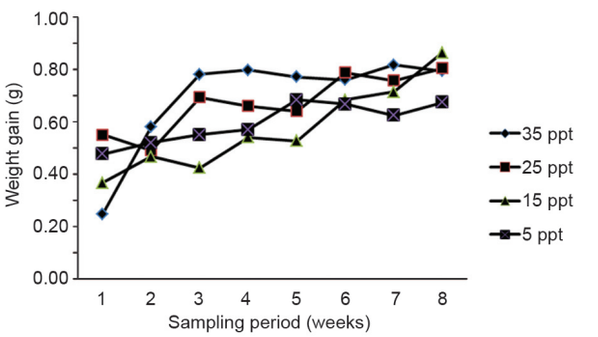

Fig. 3. Weight gain in juvenile pompano *vs* rearing water salinity

Moe *et al.* (1968) acclimatised pompano *Trachinotus carolinus* to 9 ppt and then to 1.3 ppt salinity without any mortality. Minimum salinity for survival of the ovate pompano *Trachinotus ovatus* was determined by gradual adaptation and the fish could withstand 1.5 ppt salinity. Chervinski (1973) reported that on direct transfer it could withstand 20 ppt salinity. Mc Master *et al.* (2006) found that *T. carolinus* grew as well in 19 ppt salinity water as they do in normal seawater (35 ppt). *T. ovatus* tolerated a

Table 1. Survival and growth of juvenile silver pompano at different salinities

Treatment	Survival (%)	Initial length (cm)	Final length (cm)	Initial weight (g)	Final weight (g)	Weight gain (g)	SGR
Control	93.33±3.85	4.64 ±0.05	7.61 ± 0.05	1.94 ± 0.05	7.20 ± 0.09	5.30±0.04	2.07± 0.03^a
T_1	77.80±2.22	4.59 ±0.30	7.56 ± 0.35	1.91 ± 0.38	7.29 ± 0.57	5.38±0.19	2.18± 0.20^a
T_2	82.20±2.01	4.47 ±0.40	7.59 ± 0.34	1.33 ± 0.56	6.92 ± 0.52	5.59±0.05	2.42±0.10^a
T_3	73.33±3.84	4.38 ±0.14	7.18 ±0.16	1.44 ± 0.11	6.65 ±0.19	5.21±0.10	1.83± 0.32^b

Values within a column, and with same superscript in the case of SGR, are not significantly different ($p>0.05$).

wide range of salinity (35 to 3 ppt) and grew to marketable size (approximately 500 g) in one year under moderate salinity. Juveniles of pompano have been captured in water bodies with salinities as low as 9 ppt and as high as 50 ppt (Finucane, 1969; Perret *et al*., 1971; Gilbert and Parsons, 1986).

In our observation, reduction of salinity to 5 ppt resulted in relatively lower survival as well as growth ($p< 0.5\%$) and the recommended range for low salnity culture of pompano is 15-25 ppt (Table 2). The present study indicates that the culture of silver pompano in low saline (15 ppt to 25 ppt) water bodies might be feasible.

Table 2. Recommended range for low salinity culture of pompano in Inland waters

Species	Minimum salinity required for survival	Recommended range for low salinity culture	References
Trachinotus ovatus	1.5 ppt	15 - 25 ppt	Chervinski *et al.* (1973); Jian-sheng *et al*. (2008)
Trachinotus carolinus	1.3 ppt	12 - 19 ppt	Moe *et al*. (1968); Wills *et al.* (2007)
Trachinotus marginatus	5 ppt	10 - 20 ppt	Costa *et al.* (2008)
Trachinotus blochii	4 ppt	15 - 25 ppt	Present study (2011)

The 72 h LC_{50} of wild caught pompano captured at 23 ppt was 3.5 ppt (Allen and Avault, 1970). The 72 h LC_{50} of the same wild caught pompano acclimated for 12 days at 5 ppt was 1 ppt. Allen and Avault (1970) also observed that juvenile pompano were able to grow at a salinity of 5 ppt. At temperatures of 22-27 °C and an initial salinity of 32-33 ppt, juvenile pompano were able to tolerate salinities as low as 2 ppt and as high as 45 ppt (Kumpf, 1971). Juveniles apparently tolerate a somewhat greater range of salinity, some having been observed in waters with salinities as low as 9 ppt (Gunter and Hall, 1963) and as high as 50 ppt (Perret *et al*., 1971). When Moe *et al*. (1968) transferred five pompano directly from seawater to freshwater, the fish went into a state of shock and died within 7.5 h and from the results of the experiment they inferred that pompano possibly could, under controlled conditions, adapt to freshwater. The same observation was confirmed in the present study too. Four numbers of pompano taken from waters with a salinity of 29 ppt and placed in water with a salinity of 9 ppt showed no stress, and were maintained at 9 ppt for 16 days. The salinity was then gradually reduced over 3 days to 1.3 ppt without mortality.

Main *et al.* (2008) found that, *T. carolinus* reared in salinities as low as 5 ppt suffered high mortality and reported that minimum salinity concentration of 10 ppt may be better for pompano farming. Wills *et al*. (2007) studied the growth and survival of *T. carolinus* in different salinities of 1, 3 and 28 ppt and observed 42%, 52% and 96% survival respectively at 28 °C. Jian-sheng *et al.* (2008) studied the effect of different salinity levels (10, 15, 20, 25, 30 and 35 ppt) on *T. ovatus* juveniles and concluded that salinity of 25 ppt is favourable for its growth and the maximum SGR observed was 3.21% day^{-1}. Chavez *et al*. (2011) reported that in *T. blochii* cultured in the salinity range of 30-35 ppt, the SGR ranged from 2.63 to 2.72% BW day^{-1}.

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References

Allen, K. O. and Avault, J. W. Jr. 1970. Effects of salinity and water quality on survival and growth of juvenile pompano, (*Trachinotus carolinus*). *Coastal Studies Bulletin* No. 5, Louisiana State University, Baton Rouge, LA, p. 147-155.

Cardona, L. 2000. Effects of salinity on the habitat selection and growth performance of Mediterranean flathead grey mullet *Mugil cephalus* (Osteichthyes, Mugilidae). *Estuarine Coastal Shelf Sci.*, 50: 727-737.

Chavez, H. M., Fang, A. L. and Carandang, A. A. 2011. Effect of stocking density on growth performance, survival and production of silver pompano, *Trachinotus blochii*, (Lacépède, 1801) in marine floating cages. *Asian Fish. Sci.,* 24: 321-330.

Chervinski J. and Zorn, M. 1973. Pompano, *Trachinotus ovatus* L. (Pisces, Carangidae) and its adaptability to various saline conditions. *Aquaculture,* 2(3): 241–244.

Chervinski, J. and Zorn, M. 1977. Note on occurrence and the food of juvenile kachlan (*Trachinotrus ovatus*), Linnaeus (Pisces, Carangidae)) from the Mediterranean. *Aquaculture*, 10: 175- 185.

Costa, L. F., Miranda-Filho, K. C., Severo, M. P. and Sampaio, L. A. 2008. Tolerance of juvenile pompano *Trachinotus marginatus* to acute ammonia and nitrite exposure at different salinity levels. *Aquaculture,* 285: 270-272.

Finucane, J. H. 1969. Ecology of the pompano (*Trachinotus carolinus*) and the permit (*T. falcatus*) in Florida. *Trans. Am. Fish. Soc.*, 98: 478-486.

Gilbert, C. and Parsons, J. 1986. Species profile: life histories and environmental requirements of coastal fishes and invertebrates (South Florida): Florida pompano. *U.S. Fish and Wildlife Report*, 82: 11- 42.

Gunter, G. and Hall, G. H. 1963. Biological investigations of the St. Lucie Estuary (Florida) in connection with Lake Okeechobee discharge through the St. Lucie canal. Gulf Coast Research Laboratory, *Gulf Research Reports* 1 (5): 189-307.

Huang Jian-sheng, Chen Gang, Yang Jian, Zhang Jian-dong, Shi Gang, Zhou Hui and Tang Bao-gui 2008. Effect of salinity on energy budget of *Trachinotus ovatus* juveniles. *J. Guangdong Ocean Univ.,* 27: 30-34.

Kumpf, H. E. 1971. *Temperature-salinity tolerance of the Florida pompano,* (*Trachinotus carolinus* Linnaeus). Ph.D. Dissertation, University of Miami, Miami, FL.

Main K., Resley, M., Rhody, N., Nystrom, M., Stevens, T. and Adams, C. 2008. *An overview of Florida pompano Trachinotus carolinus research at Mote Aquaculture Research Park.* (www.hbai.fau.edu).

McMaster, M. F., Kloth,T. C., Coburn, J. F. and Stolpe, N. E. 2006. Florida pompano *Trachinotus carolinus* is an alternative species for low salinity shrimp pond farming. *Aquaculture America 2006*. Mariculture Technologies International Inc. http//www.mariculturetechnology.com/MTIPompano2006.pdf.

Moe, M. A. Jr., Lewis, R. H. and Ingle R. M. 1968. Pompano mariculture: preliminary data and basic considerations. *State of Florida Board of Conservation Technical Series,* 55: 65.

Perret, W. S., Latipie, W. R., Pollard, J. F., Mock, W. R., Adkins, B. G., Gaidry, W. J. and White, C. J. 1971. Fishes and invertebrates collected in trawl and seine samples in Louisiana estuaries. *Louisiana Wildlife and Fisheries, Commission Cooperative Gulf of Mexico estuarine inventory,* p.39-105.

Sampaio, L. A., Tesser, M. B., Burkert, D. 2003. Tolerância de juvenis do pampo *Trachinotus marginatus* (Teleostei, Carangidae) ao choque agudo de salinidade em laboratório. (Abstract) *Ciênc. Rural*., 33: 757-761.

Wills, P. S., Pfeiffer T. J. and Riche, M. A. 2007. *Production of Florida pompano Trachinotus carolinus in low salinity systems.* (www.hbai.fau.edu).

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