

Seinability of four strains of Nile tilapia, *Oreochromis niloticus*, in Chinese ponds

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Abstract

Seinability of four strains of Nile tilapia, *Oreochromis niloticus*, was studied in earthen ponds in Huzhou, Zhejiang Province in China during 1995 and 1996. The accumulated seinability of the GIFT, Egypt 88, Sudan 78 and Egypt 92 strains was compared based on three trawls. Seinability of the GIFT strain was higher ($P < 0.01$) than that of other strains. In 1995, the seinability of the GIFT line (67% of the population captured) was higher than that of Egypt 88 (38%), Sudan 78 (23%) and Egypt 92 (22%). In 1996, the seinability of the GIFT line (81.5%) was higher than that of the Egypt 88 strain (62%). The utilization of the GIFT line will improve harvestable production in China. © 1999 Elsevier Science B.V. All rights reserved.

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1. Introduction

Seinability is an important characteristic for developing country aquaculture. In some farming systems, ponds are not drained. Production of edible fish then depends on the ability to remove or harvest the fish. As water resources become more limiting, water reuse more common, and unpolluted water less available, harvestability will become increasingly important. In low input systems, maximum standing crops can be achieved rapidly and production will then be even more closely associated with the ability to

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remove harvestable fish from the system to allow smaller fish the opportunity to grow. Harvesting inefficiency also has an economic cost related to harvest mortality as the fish remaining in the pond are stressed when the water is drained.

Low seinability of tilapia is a problem in the pond culture of tilapia. In China, which is the largest producer of farmed tilapia in the world with a production of 314,903 mt of Nile tilapia, representing 66% and 34% of the world's Nile tilapia and total tilapia production, respectively (FAO, 1997), low catch rates result in large losses because tilapia cannot overwinter naturally in most of China. There are no reports on seinability of tilapia in China. Limited research indicates that genetic effects can significantly effect seinability of tilapia. Dunseth (1977) found that 50% of males of the *Oreochromis niloticus* female $\times$ *O. hornorum* male hybrid were caught in a single seine haul compared to 2% for both *O. niloticus* and *O. aureus* males in polyculture with channel catfish, *Ictalurus punctatus*, and Chinese carps. Additionally, when the ponds were drained, *O. niloticus* and *O. aureus* buried themselves in the mud while the hybrid did not. The objective of the current experiment was to examine seinability of four strains of Nile tilapia, *O. niloticus*, GIFT and Egypt 92, Egypt 88 and Sudan 78. The latter two are normally utilized in China.

2. Material and methods

The experiment was conducted in 1995 and 1996 at Huzhou Fish Breeding Farm in Zhejiang Province. Four rectangular, earthen ponds of equal area (730 m²), with flat bottoms were used for trials. Mean depth of water was 123 cm in 1995 and 130 cm in 1996. The bottom of the ponds had 8 to 15 cm of mud.

Strains of tilapia used in the 1995 trial were the GIFT, Egypt 92, Egypt 88 and Sudan 78. The four strains were communally evaluated in four replicate ponds. The GIFT line of Nile tilapia was developed by crossing eight strains of Nile tilapia (four wild African strains and four domestic Asian strains) (Eknath et al., 1993), followed by one generation of combined family and mass selection for body weight, before the GIFT line was transferred to China. Egypt 88 was a strain of Nile tilapia introduced into China from Egypt in 1988. Sudan 78 was a strain of Nile tilapia introduced into China from Sudan in 1978. Egypt 92 was a strain used to developed the GIFT line (Eknath et al., 1993) introduced from ICLARM into the Philippines in 1992, then transferred to China in 1994.

When the fish were 2 months old, they were tagged by fin-clipping: left pelvic fin for GIFT, right pelvic fin for Egypt 88, left pectoral fin for Sudan 78 and right pectoral fin for Egypt 92. Fish were stocked on July 14, 1995 and stocking density was 800 fish per pond for each strain. Initial weights were 2.6, 2.6, 3.1, and 1.2 g for GIFT, Egypt 88, Sudan 78 and Egypt 92, respectively. Fish were harvested on Oct. 12, 1995. Mean weight at harvest was 188.6 ± 43.8 g for GIFT, 172.1 ± 40.9 g for Egypt 88, 178.8 ± 41.9 g for Sudan 78, and 156.7 ± 45.6 g for Egypt 92. Sex ratios were 1.3:1, 1.2:1, 0.6:1 and 0.8:1 for GIFT, Egypt 88, Sudan 78 and Egypt 92, respectively.

The fish were first caught with three trawls, and the remainder were harvested when the pond was drained. The seine was nylon, 25 m long, 2.5 m deep, 3 cm mesh with no

bag. The seine had a mud line with lead weights every 2 m. Each pond was seined three times in succession before moving to the next pond, and each seine haul took about 10 min to complete. Four men pulled the seine and two men held the mud line down. The top line floated free, and a few fish escaped by jumping over the top line. The number of fish captured in the trawls and the total number harvested were recorded. Seinability, percentage of fish captured in three trawls was calculated for each strain.

In 1996, GIFT and Egypt 88, were tested again since they had the highest seinability in 1995. Two ponds were communally stocked with 600 fish of each strain per pond, marked as above, and two ponds were separately stocked with 1200 fish per pond on May 7, 1996. Initial weights were 28.3 and 26.6 g for GIFT and Egypt 88, respectively. Fish were harvested on Sept. 20 when mean weight was 265.4 ± 37.1 g for GIFT and 233.4 ± 50.5 g for Egypt 88. Sex ratios were 1.1:1 and 1.0:1 for GIFT and Egypt 88, respectively. During harvest, ponds were trawled three times after pond water was reduced to 1-m depth. The number of fish caught was recorded. Then the pond was drained and all fish harvested and enumerated. Seinability of each strain was calculated. Means were evaluated with a paired-sample *t*-test (Zar, 1974).

3. Results and discussion

In the 1995 trial, average seinability for the pooled three trawls was 67% for GIFT, 38% for Egypt 88, 23% for Sudan 78 and 22% for Egypt 92, respectively. Seinability of the GIFT line exceeded that of Egypt 88 by 79%, Sudan 78 by 206% and Egypt 92 by 226% (Table 1).

In the 1996 trial, average seinability for the pooled three trawls was 82% for GIFT and 62% for Egypt 88, respectively. Harvestability of the GIFT line exceeded Egypt 88 by 32% (Table 1). In most of China, tilapias are cultured in pond systems with Chinese carps. Chinese carps are usually harvested between New Year and the Spring Festival. Because tilapia have a low tolerance to cold and must be harvested prior to the harvest season for Chinese carps and tilapia have a low catchability, those tilapia remaining in the pond because they escaped captured by seining will die, resulting in a significant production loss. This is a big obstacle for the tilapia industry in China. High seinability

Table 1

Mean seinability of different strains of Nile tilapia, *O. niloticus*, from three trawls in earthen ponds in China

Strain	Year	Mean seinability $\pm$ s.d.	
		Communal environment	Separate environment
GIFT	1995	67 ± 9^a	
Egypt 88	1995	38 ± 6	
Sudan 78	1995	23 ± 4	
Egypt 92	1995	22 ± 5	
GIFT	1996	82 ± 2^a	81 ± 1^a
Egypt 88	1996	60 ± 3	67 ± 2

^a Mean seinability of GIFT was higher than other strains ($P < 0.01$).

would be advantageous for tilapia caught and sold in autumn and for extending tilapia culture season in China.

Harvestability of all strains was lower in the 1995 trial than in the 1996 trial, probably because water depth of ponds in the 1996 trial was decreased to 1.0 m during harvest compared to 1.5 m in 1995. Strains with a lower catch rate escaped at higher rates in deeper waters.

Khater (1985) also found differences in seinability among different strains of Nile tilapia. Strains with longer histories of culture tended to be harder to catch. This suggests the possibility of inadvertent selection for individuals difficult to seine. This could be a result of the tendency of farmers to market the fish they first catch, and then later choose future brood stock from what remains in the pond. Obviously, this is a selection for ability of fish to escape harvest by seining.

Strain differences for seinability have been observed for several aquaculture species including channel catfish, *I. punctatus*, (Dunham, 1996) and common carp, *Cyprinus carpio*, (Wohlfarth et al., 1975). Interspecific hybridization usually results in improved seinability (Dunham, 1996). Selection for increased body weight in channel catfish (Rezk, 1993) has not affected seinability. In the current study, the easiest fish to capture is a selected line. However, we are unable to ascertain any correlated responses to selection since the base population from which the GIFT line was derived was not included in the evaluation.

In year two, GIFT and Egypt 88 were compared both communally and separately. The catch rates were virtually identical for the two strains in both environments. This indicates that communal evaluation is a valid technique for comparing different genotypes of Nile tilapia for seinability.

The GIFT line had a higher catch rate than the other strains during both years and at both water depths. Other reports regarding the catch rate of tilapia indicate that the seinability of Nile tilapia was 15–20% (Xu and Tu, 1982; Wan et al., 1989), which is lower than our value for the GIFT line. In countries where the farming system, harvest system or weather affects the ability to seine and harvest tilapia, utilization of the GIFT line Nile tilapia will increase harvestability and true consumable, marketable production.

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