BRACKISHWATER CULTURE OF TILAPIAS IN THE PHILIPPINES: AN ASSESSMENT

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Introduction

The Philippines is a major producer of farmed tilapias in the world. The country produced 122,316 metric tons (mt) of tilapias in 2002, 93% of which was from freshwater ponds and cages, and only 7% from brackishwater ponds (BFAR, 2003).

In 1991, the production of tilapias from brackishwater ponds in the Philippines was 14, 072 mt or 18.4% of total production for tilapias. For the period 1996-2002, there was a 172% increase in the production of tilapias in brackishwater ponds with a mean annual growth of 8% (Table 1).

Table 1. Annual production of tilapias in brackishwater ponds in the Philippines (1996-2002).

Year	Production (mt)
1996	4,816
1997	5,939
1998	5,949
1999	7,068
2000	7,189
2001	9,499
2002	8,266

Source: Bureau of Agricultural Statistics

Since the introduction of the Mozambique tilapia *(Oreochromis mossambicus)* to the Philippines in 1950 and the Nile tilapia *(O. niloticus)* in 1972, tilapias have become the second most important foodfish grown in ponds. Milkfish *(Chanos chanos)* is the predominant cultured species in the country's 239,323 hectares of brackishwater ponds followed by the tiger shrimp *(Penaeus monodon)* and the Mozambique tilapia.

This paper shall review the research and field trials conducted in the Philippines on the culture of tilapias in brackishwater ponds and cages, and assess its potential for further commercial production.

Research and field trials on brackishwater culture of tilapias

In the 1950s, the Mozambique tilapia which was introduced as a freshwater foodfish for culture in backyard ponds escaped into natural waters and became established in estuaries. The prolific euryhaline species then invaded brackishwater ponds and became a "pest" by competing with milkfish for its natural food known as lab-lab.

With the fuel crisis and marine fish shortage of the 1970s, the Mozambique tilapia was given a second look. Research on its culture in brackishwater ponds began in 1975 at the Brackishwater Aquaculture Center of the University of the Philippines (UP-BAC) in Leganes, Iloilo. Studies on the monoculture of tilapias with pond fertilization and feeding were conducted (Fortes, 1987).

The tilapia species studied were the *O. mossambicus* (Fortes and Villa, 1975), the *O. niloticus* (Corre, 1981) and the hybrid red tilapia (Fortes, 1987). The species were bred in tanks at sizes of 30-100 g with stocking densities of 2-4/m^2, sex ratio of three females to one male, and salinity of less than 15 ppt. The produced fry were then reared in nursery units (tanks or net enclosures in ponds) to fingerling size for grow-out in brackishwater ponds. Prior to stocking, the fingerlings were acclimated to the salinity of the water in the ponds.

A summary of the experimental production data of the tilapia species cultured in the brackishwater ponds of the UP-BAC is presented in Table 2.

Table 2. Experimental production data of tilapia species cultured in brackishwater ponds.

Species	Salinity (ppt)	Stocking Density (no./m^2)	Stocking Size (g)	Harvest Size (g)	Culture Period (days)	Growth Rate (g/day)	Survival (%)	Production (kg/ha)	Source
O. mossambicus (all-male)	13.7 - 53.7	0.4	16.7	107.2	80	1.13	100	430.6	Fortes and Villa (1975)
O. niloticus (mixed sex)	14 – 35	1	4.1	125.5	90	1.34	82	1,005	Corre (1981)
Hybrid Red Tilapia (mixed sex)	31.5 - 32.1	1	8.4	179	120	1.41	82.7	1,384.90	Fortes (1987)

The studies showed that the *O. mossambicus* had the highest survival and tolerance to salinity of the species tested followed by the hybrid red tilapia *(O. mossambicus x O. niloticus)* and *O. niloticus*. The hybrid tilapia had the best growth rate and production followed by the *O. niloticus* and *O. mossambicus*.

In tank experiments, Villegas (1991) also found that the *O. mossambicus* was more salt-tolerant than the *O. niloticus* and that the F_1 hybrids of *O. mossambicus* and *O. niloticus* had good growth and survival at salinities of 15-32 ppt.

In the commercial brackishwater pond trials conducted by the private sector, the best growth was attained with sex-reversed *O. mossambicus* (Iloilo strain) followed by the sex-reversed hybrid and all-male hybrid. The highest survival was attained with the sex-reversed hybrid followed by the sex-reversed *O. mossambicus* and all-male hybrid. The all-male hybrid had the highest production at a stocking density of 10/m^2 and culture period of six months (Table 3).

Table 3. Commercial production data of tilapia species cultured in brackishwater ponds.

Species	Salinity (ppt)	Stocking Density (no./m^2)	Stocking Size (g)	Harvest Size (g)	Culture Period (days)	Growth Rate (g/day)	Survival (%)	Production (kg/ha)	Source
O. mossambicus (sex-reversed)	20 - 35	1.5	1.5	275	125	2.2	82.5	2,269[a]	Corre, pers. comm.
O. mossambicus X *O. niloticus* (sex-reversed)	25 - 35	1	1.5	305	180	1.7	86	6,000[b]	Guerrero and Cornejo (1994)
O. mossambicus x *O. hornorum* (all-male)	22	10	1.5	300	180	1.6	80	10,000[a]	Guerrero (1999)

[a] With feeding only
[b] With fertilization and feeding

For cage culture in a brackishwater river, the sex-reversed hybrid of *O. mossambicus x O. niloticus* showed potential for commercialization with good growth, survival and production (Table 4).

Use of tilapias for "Green Water" in shrimp culture ponds

An interesting development in the 1990s was the use of salt-tolerant tilapias for the "green water technology" in the control of the vibriosis disease of tiger shrimp *(P. monodon)* in brackishwater ponds. The technology involves the culture of hybrids (e.g., red tilapia, *O. mossambicus x O. niloticus* and *O. mossambicus x O. hornorum*) in cages within the shrimp culture pond or in a separate pond, to produce "green water" with the manuring action of the fish for inducing blooms of green algae such as the *Chlorella*. Such an effect is believed to suppress the luminous bacterium, *Vibrio harveyi,* causing shrimp mortalities. A biomass of at least three tons of tilapia per hectare is maintained for effective control of the pathogen with the technology which was adapted from Thailand by local shrimp farmers (Guerrero, 1999).

Table 4. Experimental production data of tilapia hybrid cage cultured in a brackishwater river.

Hybrid	Salinity (ppt)	Stocking Density (no./m^3)	Stocking Size (g)	Harvest Size (g)	Culture Period (days)	Growth Rate (g/day)	Survival (%)	Production (kg/m^3)	Source
O. mossambicus x *O. niloticus*[a]	15 - 30	200	5	186	108	1.7	86	32	Dureza *et al.* (1994)
O. mossambicus x *O. niloticus*[b]	28	200	24	317	103	2.8	80	63	Dureza *et al.* (1994)

[a] Iloilo strain
[b] Laguna strain

Requirements for further development

Despite the bright prospects for expanding the production of tilapias in brackishwater ponds and cages in the country, the extent of adoption by farmers of the required hatchery and grow-out technologies has been limited. This limitation is attributed to two major factors: (1) the lack of salt-tolerant tilapia fingerlings, and (2) inadequate extension services for the dissemination of the technologies.

There is need for more hatcheries for the mass production of salt-tolerant tilapia fingerlings particularly in areas where brackishwater ponds and cages in estuaries are not fully utilized because of the lack of suitable fish seeds for stocking. Extension services through training and field demonstrations also need to be beefed up especially at the local level for effective dissemination of the brackishwater culture of tilapias in ponds and cages.

In the Master Plan for tilapia industry prepared by the Department of Agriculture of the Philippines in consultation with the various stakeholders, one of the strategies identified is the nationwide promotion of brackishwater culture of tilapias.

Summary and recommendations

Experimental studies on the culture of tilapias in brackishwater ponds began in the Philippines in the mid-1970s. Of the species studied, *O. mossambicus* was found to be the most salt-tolerant while the hybrid tilapia *(O. mossambicus x O. niloticus)* had the best growth and production. The sex-reversed tilapia hybrid also showed good potential for cage culture in a brackishwater river.

Sex-reversed *O. mossambicus* and *O. mossambicus x O. niloticus,* and all-male *O. mossambicus x O. hornorum* fingerlings are now commercially produced for use in the "green water technology" for controlling vibriosis of *P. monodon* cultured in brackishwater ponds.

For wider adoption and increased production of tilapias in brackishwater ponds and cages nationwide, the establishment of more hatcheries for salt-tolerant tilapias and the beefing up of extension services at the local level are recommended.

References

Bureau of Fisheries and Aquatic Resources. 2003. *Philippine Fisheries Profile 2002*. Department of Agriculture, Quezon City. 57 p.

Corre, V. L. 1981. "Culture of Nile Tilapia in Brackishwater Fishponds Using Supplemental Feeds Containing Various Levels of Protein." M. S. Thesis. University of the Philippines, College of Fisheries, Diliman, Quezon City. 38 p.

Dureza, L. A., C. C. Gempis, R. C. Salvador, R. P. Sombero and B. D. Belmonte. 1994. "Effects of Selected Factors in the Growth and Survival of Tilapia Hybrids Raised in Cages in Saline Water," pp. 41-44. *In*: Villacorta, L. G. and L. A. Dureza (eds.). *Tilapia Farming: Genetic Improvement and Advances in Culture Technology*. PCAMRD, Los Baños, Laguna. 86 p.

Fortes, R. D. and V. U. Villa. 1975. "Monoculture and Polyculture of Bangus and All-Male Tilapia in Brackishwater Ponds (1)." *Inland Fish. Proj. Tech. Rep. No. 7, Second Half of FY 1975 NSDB-assisted Project No. 7103 Ag*. UPV College of Fisheries, Diliman, Quezon City.

Fortes, R. D. 1987. "Culture Studies on *Tilapia sp.* Under Saline Conditions at the Brackishwater Aquaculture Center," pp. 21-33. *In:* Guerrero, R. D., D. L. Guzman and C. M. Lantican (eds.). *Tilapia Farming*. PCARRD, Los Baños, Laguna. 68 p.

Guerrero, L. A. and R. G. Cornejo. 1994. "Hatchery, Nursery and Grow-out Techniques for Tilapia in Brackishwater Ponds," pp. 34-39. *In*: Villacorta, L. G. and L. A. Dureza (eds.). *Tilapia Farming: Genetic Improvement and Advances on Culture Technology,* PCAMRD, Los Baños, Laguna. 86 p.

Guerrero, R. D. 1999. "Green Water" With Tilapia Controls Shrimp Disease". *Agriculture, 3(12): 18-19.*

Villegas, C. T. 1991. "Growth and Survival of *Oreochromis mossambicus, O. niloticus* and their F_1 Hybrids at Various Salinities". *SEAFDEC Asian Aquaculture XIII (1): 3-5.*