

# Genes and Fish

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## Tilapia: A species for Indian Aquaculture?

A few years back when I was just starting out on a collaborative project to evaluate and initiate improvements to the genetic status of carps used for aquaculture in Southern India, I was asked to give a talk to District DOF officials and hatchery managers on the topic of broodstock management in carps. When I was introduced my host made mention of my background in tilapia genetics. The participants listened attentively to what I had to say about the potential impacts of poor management on the genetic quality of cultured carp stocks and to recommendations on how management can be improved. When it came to the question and answer phase of the presentation, I recall that virtually every one of the questions related not to carp but to tilapia and we basically got completely side tracked into a fairly heated debate on the pros and cons of the introduction of tilapia (we were talking principally about the Nile tilapia *O. niloticus*) for aquaculture in India. I seem to remember the consensus opinion among the participants was generally negative towards tilapia but the reasons for this poor opinion of the species were not clearly defined. I suspect that there were two main reasons for the negative reaction to the introduction of tilapia.

Firstly, as is almost universally the case, the ubiquitous *O. mossambicus* was the first tilapia to be introduced into India and was already widespread. It had quickly gained a reputation of being a pest, commonly occurring in quite large numbers in carp polyculture systems where it was perceived to compete with one or more of the carps, limiting the productivity of the systems. Due to overpopulation and stunting the *O. mossambicus* did not

reach a large size and therefore had minimal economic value although in communal water bodies they may have been a resource for the poor.

The second major factor acting against tilapia was the doubts over whether there was a significant market for the fish. In a society that is very familiar with carps as the major inland aquaculture species, typically being sold at sizes of around 1 kg or more, the size and form of the tilapia would be considered quite a departure from the norm.

Concerns were also expressed, although not well elucidated, over the effect that the introduction and spread of tilapia might have on the environment and particularly on the diversity of indigenous species.

At the time I was very familiar with the success stories of tilapia where introductions had led to the development of very significant inland aquaculture production, nowhere more so than in the Philippines, where I was then based, where tilapia is synonymous with inland aquaculture. I was then less familiar with the situation of the predominantly carp-based aquaculture that dominates in the sub-continent, about which I have since learned a lot (that's not to say there is not much more to learn). Thus, at the time, I sat on the fence and neither recommended nor rejected the idea that the Nile tilapia should be widely introduced for aquaculture in India, limiting our discussion to the pros and cons.

With the benefit of more experience of the issues and given that the interest in tilapia aquaculture in India is steadily rising, I thought it would be timely to revisit some of the issues that

were raised during that meeting many years ago.

The main potential disadvantages of the widespread adoption of *O. niloticus* for aquaculture remain the same as outlined above, namely the risk that the fish would suffer the same problems evident with *O. mossambicus* and that there would be no significant market for the product.

It is my view that the uptake of *O. niloticus* into Indian aquaculture is unlikely to be beset by the same problems associated with *O. mossambicus*. The species matures at a larger size and is less fecund and thus less prone to overpopulation and stunting. Also evidence from other introductions throughout the region is that *O. niloticus* aquaculture is commonly sustained where initial introductions of *O. mossambicus* have failed. Tilapia is used extensively in both monoculture and polyculture and it likely that it will be used for both forms in India. The phytoplankton filtering and periphyton grazing tilapia do not compete directly with any of the Indian major carps although there may be some overlap in feeding niches. Tilapia then is likely to enhance the productivity of polyculture systems in ponds and tanks (reservoirs) as evidenced by its adoption in such systems in other countries such in northern Vietnam. It is also probable that some farmers will initiate monoculture of tilapia in ponds and



*Tilapia have enhanced productivity of polyculture systems, making a significant proportion of harvest as seen here in a sewage-fish systems in northern Vietnam*

cages and there may even be some development of more intensive tilapia culture targeting export markets. Provided that good quality tilapia feeds become available at reasonable cost (and commercial feeds are already available for other species), there is no obvious reason why entrepreneurial Indian producers cannot compete in the international marketplace.

Tilapia culture will not flourish however without the establishment of local markets, both urban and rural. Indian fish consumers are very familiar with the major carps and the methods of cuisine have evolved to suit these species. However, tilapia has become popular among fish consumers in other south Asian countries. The tilapia that are currently available in Indian markets (either from fisheries or “informal” aquaculture) are considered as a poor man’s fish and it may take time and some targeted marketing for the species to become popular amongst the higher castes, particularly if it is priced at the same level as carps.

The issue of the potential deleterious environmental impact of the introduction of Nile tilapia is more difficult to assess and should be properly addressed with the conduct of environmental impact assessments prior to any changes in legislation over introductions taking place. The main problem with conducting such assessment is that there is very little published information on the impact of introductions of Nile tilapia as an exotic species, on which to base any predictions. The few studies that have been made cite isolated examples of competition with indigenous species, possibly leading in some cases to local

extinctions, although it is difficult to determine whether the tilapia is the main factor in such extinctions. Overall, the numbers of negative environmental impacts recorded from the introduction of tilapia are very few and undoubtedly more would have been recorded if more impacts had indeed occurred.

It must be accepted that adoption of the Nile tilapia for aquaculture will lead to the formation of feral populations of the species in natural and man made water bodies where the climate is suitable for year round survival and reproduction of the species. This may be lessened to some extent by the adoption of monosex culture but this is unlikely to effectively eliminate colonization. The Nile tilapia will thus qualify as an invasive species as has already happened with *O. mossambicus* throughout large parts of the country. *O. niloticus*, however, may well be less successful a colonizer than *O. mossambicus* due to the higher fecundity and wider environmental tolerances of the latter species.

The environmental risks of the introduction of carnivorous species such as the African catfish are quite easy to appreciate, even among those who are not conservation minded. However, the impact of omnivores or herbivores such as the Nile tilapia, which could still be very significant particularly where it invades environments lacking major predators or competing species, is more difficult



*Cage culture could be an option for commercialized monoculture of tilapia in some states of India with rich water resources*

to appreciate. Even if local extinctions are avoided significant changes in the population dynamics of fish species in many water bodies is likely. In purely economic terms such changes may have positive or negative implications with regard to yields from associated fisheries.

One of the main arguments that could be made by a pro-tilapia lobby, given that *O. mossambicus* is already widespread (and indeed *O. niloticus* itself can already be found in many locations), is the question of whether there is really any significant further risk from the wider formalized introduction of another closely related tilapia species? Set against the productivity and economic and livelihood benefits that tilapia culture has brought to many Asian countries, pro tilapia lobbyists would argue that localized and small scale impacts on indigenous diversity, usually on species with limited economic importance, are a relatively small price to pay?

Whether a relaxation in legislation on introduction and culture of the Nile tilapia in India (or indeed other tropical or sub-tropical countries outside its natural range where it is not yet ubiquitous) is a good idea or not depends mainly one’s position on conservation and the interpretation of the extent of the threat posed by invasive colonization by a new tilapia species. The case for Nile tilapia is perhaps rather easily made by pointing to the significant economic and food security benefits that its culture has brought to many other countries in the region. The counter case is more difficult to make due to the paucity of information available on the key issues of environmental impact. It may be time for the relevant authorities to actively consider the topic and to encourage open debate among stakeholders on both sides. It will be important in this debate is well informed by access to available information and involvement of appropriate expertise.