

An overview of the
biological diversity and
culture of tilapias
(Teleostei, Cichlidae)

Germain Gourène
Ichthyologist

Guy G. Teugels
Ichthyologist

Introduction

Tilapia are ranked fourth in world fish culture, behind carp

1992). According to the most recent list, the Cichlidae family has 143 genera on the African continent (DAGET *et al.*, 1991).

Until recently the tilapias formed a single taxonomic unit, a generic rank, in the Cichlidae : *Tilapia* (*sensu lato*). Based on ethological characteristics, later supported by morphological and osteological criteria, TREWAVAS (1983) classified the tilapias in four genera belonging to the sub-family Tilapiinae. These are : *Tilapia* Smith, 1840 *sensu stricto*, *Sarotherodon* Rüppell, 1882 and *Oreochromis* Günther, 1889 and *Danakilia* Thys van den Audenaerde, 1969. The first three are of interest to aquaculture. They are briefly discussed below.

Genus *Tilapia* Smith, 1840

The genus *Tilapia* *s.s.* only contains the species that fix their eggs on a substrate, contrary to the other genera which perform oral incubation. Besides this ethological characteristic, the *Tilapia* species differ from other tilapias by the inferior pharyngeal bone which is as long as it is wide with the anterior point shorter than the toothed section ; the posterior pharyngeal teeth are bicuspid or tricuspid (sometimes quadricuspid). There are a maximum of 17 gill rakers on the lower part of the first branchial arch *versus* 28 in the other genera. Thirty-eight species are currently recognized (TEUGELS et THYS VAN DEN AUDENAERDE, 1991 ; STIASSNY *et al.*, 1992). Several of them have been tested in aquaculture (see

T. zillii). The caudal fin is clearly truncated (the end seems to have been cut). The eggs are yellow. Adults are colored olive green, darker on the back ; the chest and belly are a dirty white marked with black and cherry-red spots which extend to the cheeks and the lower flanks ; the lower part of the caudal fin is reddish (yellow), the upper part is greenish or marked ; dark vertical bars may appear on the flanks. In young fish (about 5 cm), the pelvic fins are orange in *T. rendalli* and without color in *T. zillii*. The natural distribution

The natural distribution of *Tilapia zillii* covers southern Morocco, the Sahara, the Nilo-Sudanian basins (Senegal, Niger, including the Benue, Volta, Chad, Nile), the Sassandra, Bandama and Comoe basins in Côte d'Ivoire, part of the Congo basin (Ubangi, Uele, Ituri), and Lakes Albert and Turkana. Eighteen metric tons of *T. zillii* were produced in 1994 on the African continent.

Tilapia guineensis generally has a strongly sloped head profile ; the dorsal profile is convex and the ventral profile is horizontal. The dorsal formula is XVI-XVI. 12-13. Bright and highly visible colors, with mixes of deep blue green, copper green, deep black and zones of bright cherry red on the lower parts of the head and body ; these colors change considerably according to the physiological state and the sexual maturity of the individual. The natural distribution of *Tilapia guineensis* covers the coastal zones (fresh and brackish waters) from the Senegal River to the mouth of the Cuanza in Angola. No data were found on the production of this species.

Genus *Oreochromis* Günther, 1889

The genus *Oreochromis* contains the species where oral incubation is exclusively practiced by the females. Added to this is the reduced size of the belly scales compared to the size of the scales on the flanks ; the genital papilla is well developed in both sexes ; the inferior pharyngeal bone is longer than or as long as it is wide ; its toothed part is as long as or a little longer than its anterior part ; the posterior pharyngeal teeth are bicuspid, or with a reduced inferior cusp or without clear cusp (TEUGELS and THYS VAN DEN AUDENAERDE, 1992).

Thirty-three species of *Oreochromis* exist in Africa. Several of these have been tested in aquaculture (see TREWAVAS and TEUGELS, 1991a, for the bibliographic review). Note that *O. niloticus* is the most polymorphic species and the species most used in aquaculture. It is distinguished from the other taxa in the same genus by a caudal fin with regular black vertical bands all along its length. The species contains 8 subspecies, of which three, according to PULLIN (1988), have been cultured (*O. niloticus niloticus*, *O. n. eduardianus* and *O. n. vulcanis*). *O. niloticus* (Figure 2) is found naturally in the

coastal basins of Israel, the Nilo-Sudanian basins and in numerous East African lakes. Its global production is estimated at 426 773 metric tons of which 27 162 are produced on the African continent(GARIBALDI, 1996).

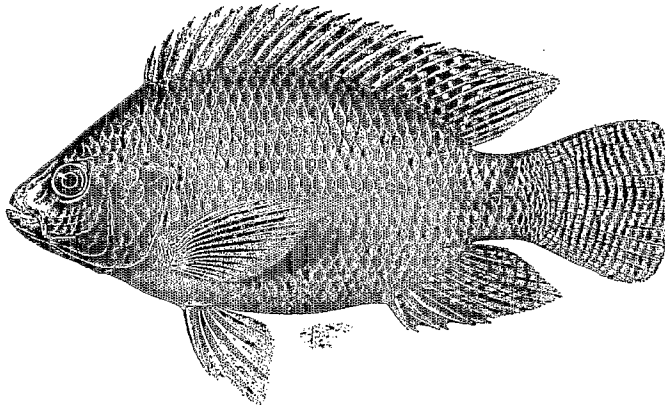


Figure 2
Oreochromis niloticus (from BOULENGER, 1907).

GARIBALDI (1996) cites six other species used in aquaculture : *Oreochromis mossambicus* (51 870 metric tons of which 55 in Africa), *O. aureus* (11 871 metric tons of which 74 in Africa), *O. andersonii* (2 200 metric tons produced in Africa), *O. macrochir* (350 metric tons produced in Africa), *O. spilurus* and *O. urolepis* (no production data).

almost the same size as those of the flanks ; the genital papilla of the male is smaller ; the inferior pharyngeal bone is longer than or as long as it is wide and its toothed part is shorter than the anterior part ; the posterior pharyngeal teeth are bicuspid or with a reduced

substrate spawners. A review of the geographical distribution of different tilapia species (DAGET *et al.*, 1991) shows clearly that the species with the greatest natural distribution are the ones that are currently used in aquaculture. In fact, a wide distribution confers to a species, without any doubt, a greater capacity to adapt to various types of environmental conditions. These adaptations, expressed in an aquaculture situation in terms of zootechnical performance, are an additional advantage.

References

- BOULENGER (G.A.), 1901 —
Les poissons du bassin du Congo.
Bruxelles: xii + 532 p.
- BOULENGER (G.A.), 1907 —
Zoology of Egypt. The fishes of the Nile
published for the Egyptian
Government. 2 vol., London: 578 p.
- BOULENGER (G.A.), 1915 —
Catalogue of the fresh-water fishes
of Africa in the British Museum
(Natural History). London, vol.3: 526 p.
- DAGET (J.), GOSSE (J.P.), TEUGELS
(G.G.), THYS VAN DEN AUDENAERDE
(D.F.E.), (Eds), 1991 —
Check-List of the Freshwater
Fishes of Africa.
Cloffa IV. ISBN (Bruxelles),
Mrac (Tervuren),
Orstom (Paris), 740 p.
- DE BONT (A.), 1950 —
Rapport annuel 1947-1948 de la
station de recherches piscicoles. Publ.
- saharienne. *Rapport d'étude*,
Ministère de la Coopération
et du Développement, 129 p.
- LAZARD (J.), LEGENDRE (M.), 1994 —
La pisciculture africaine: enjeux et
problèmes de recherches. *Cahiers*
Agric., 3: 83-92.
- NELSON (J.S.), 1994 —
Fishes of the World. 3rd édition. J. Wiley
et Sons, Inc. (New York), 541 p.
- PULLIN (R.S.V.), 1988 —
Ressources génétiques en tilapias
pour l'agriculture. Atelier,
23 - 24 Mars 1987.
Bangkok, Thaïlande, 129 p.
- STIASSNY (M.L.J.), SCHLIEUWEN
(U.K.), DOMINY (W.J.), 1992 —
A new species flock of cichlid fishes
from Lake Bermin, Cameroon with
a description of eight new species
of *Tilapia* (Labroidei: Cichlidae). *Ichth.*

Mrac (Tervuren), Orstom (Paris),
pp 482 - 508.

TEUGELS (G.G.), THYS VAN DEN
AUDENAERDE (D.F.E.), 1992 —
Cichlidae. In : Faune des poissons
d'eaux douces et saumâtres d'Afrique
de l'Ouest. LEVEQUE (C.), PAUGY (D.),
TEUGELS (G.G.), (Eds).
Mrac (Tervuren)/Orstom (Paris).
Tome II, pp 714 - 779.

THYS VAN DEN AUDENAERDE (D.F.E.),
1970 —

TREWAVAS (E.), TEUGELS (G.G.),
1991a —

Oreochromis. In: Check-List
of the Freshwater Fishes of Africa.
Cloffa IV. DAGET (J.), GOSSE (J.P.),
TEUGELS (G.G.),
THYS VAN DEN AUDENAERDE (D.F.E.),
(Eds). ISNB (Bruxelles),
Mrac (Tervuren),
Orstom (Paris),
pp 307 - 346.

TREWAVAS (E.), TEUGELS (G.G.),
1991b —