ISTC

Identifying System for Tanganyikan Cichlids

Version 3.5b

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ISTC is a program for facilitating the identification of Tanganyikan Cichlids. In Lake Tanganyika, 196 valid species of Cichlidae (Perciformes) have been described thus far (February 2007). Since most species are endemic to the lake, a majority of ichthyofauna probably originated due to intralacustrine speciation. Therefore, these species have attracted the attention of many researchers working on evolutional and ecological studies. However, the taxonomic identification of these species remains difficult because of a presence of many species similar in appearance, having overlapping morphological characters, and intraspecific variations in body color. This program will greatly facilitate in the identification of the Tanganyikan cichlids.

The program narrows the possible species down to fewer candidates based on a method similar to the quadratic discriminant analysis (QDA). Although the present method is not mathematically rigorous, its practicability was confirmed (Takahashi et al., submitted).

The ISTC version 3.5b contains data of 186 species, which contribute to 95% of all the valid species (details in Supplementary table).

Citation of ISTC
Takahashi et al. (Submitted).

Required computer system
The ISTC is built using Visual Basic for Applications (VBA) within MS Excel. A windows version "ISTC(Win)" is compatible with Excel 2002, and a macintosh version "ISTC(MacOSX)" is compatible with Excel 2004 and Excel X.

How to use
Start ISTC
1. Download the ISTC(Win) or ISTC(MacOSX) from the FishBase.

2. Click the icon to run the program on VBA in MS Excel.

Search
1. Enter the data of an unidentified specimen in the empty cells (see "Collection of data from an unidentified specimen"). This program requires one or more of the eight specified characters. More precise results would be obtained if more characters are entered.

2. Enter a level for the index I (0.01 by default, see below for the details of index I).

3. Click on "Search" button.

Reading of results
1. Candidate species, which has I_i larger than the level entered previously, are listed in the order of descending I_i. The index I_i indicates the degree of proximity between the unidentified specimen and species i. The species with a larger I_i are more likely to be the correct species to which the unidentified specimen belongs.

2. The candidate species links to the page of the respective species in the FishBase on clicking the scientific name in the list of the candidates.

3. If a plausible species cannot be found in the list of candidates, retry after a lower value is used to the level of index I.

Collection of data from an unidentified specimen

We explain how to count five meristic characters and observe three descriptive characters used in ISTC, although these methods are common in cichlids.

Meristic characters (Cha. 1 to 5)
Cha. 1: Dorsal-fin spines. The number of spines in the dorsal-fin. The spines are not segmented and unbranched. This count usually ranges from 9 to 24.

Cha. 2: Dorsal-fin soft rays. The number of soft rays in the dorsal-fin. The soft rays are segmented and usually branched. The most posterior soft ray is short and thin, and should be examined carefully. This count usually ranges from 4 to 17.

Cha. 3: Anal-fin spines. The number of spines in the anal-fin. The spines are not segmented and not branched. This count usually ranges from 3 to 12.

Cha. 4: Anal-fin soft rays. The number of soft rays in the anal-fin. The soft rays are segmented and usually branched. The most posterior soft ray is short and thin, and should be examined carefully. This count usually ranges from 4 to 19.

Cha. 5: Scales in longitudinal line. The number of scales in the longitudinal line. Count from the most anterior scale to the most posterior one in the upper lateral line, continuously count down and posteriorly following a transversal scale line to a scale on the body axis (according to the lower lateral line scale row, when the lower lateral line is present), and continuously count scales on the body axis posteriorly to the base of the caudal fin. Missing scales are included. This count usually ranges from 27 to 88.

Descriptive characters (Cha. 6 to 8)

Cha. 6: Cheek naked (0) or scaled (1). If scales make several rows on the cheek, this character is coded as "1." If the scales are absent on the cheek, or present but are small with covered by skin and not making rows, this character is coded as "0".

Cha. 7: Outer tooth uni- (1), bi- (2) or tricuspid (3). There are several rows of teeth on the upper jaw in many species. The outermost teeth are arranged regularly in a single row, are usually larger than the inner teeth. If each outer tooth has a single cusp, i.e., unicuspid tooth, it is coded as "1." If it has two or three cusps, i.e., bicuspid or tricuspid tooth, it is coded as "2" or "3," respectively. If several shapes are mixed in a single specimen, the most predominant shape should be used.

Cha. 8: Inner tooth uni- (1) or tricuspid (3), or absent (0). The inner teeth on the upper jaw are smaller than the outer teeth, usually arranged in a few irregular rows. If each inner tooth has a single cusp, i.e., unicuspid tooth, it is coded as "1." If it has three cusps, i.e., tricuspid tooth, it is coded as "3." If uni- and tricuspid teeth are mixed in a single specimen, the predominant shape should be employed. If there are no inner teeth, i.e., only the outer teeth exist, it is coded as "0."

Examples for version 3.5b

Example 1

When Cha. 1 to 8 are 18, 10, 3, 8, 34, 1, 2 and 3, and the level of index $I > 0.01$, three candidates may be listed (*Simochromis diagramma*, *Pseudosimochromis curvifrons* and *Lobochilotes labiatus*).

Example 2

When Cha. 1 to 5 are 17, 13, 3, 9 and 30, and the level of index $I > 0.01$, three candidates may be listed (*Oreochromis niloticus*, *Tilapia rendalli* and *Oreochromis karomo*).

Disclaimer

The ISTC is provided free of cost by the authors. The authors assume no responsibility for unintentional errors or problems that may be encountered by users. Individualized support for users of the program is not provided.

Acknowledgements

Supplementary table.   Number of valid species and number of species used in the ISTC version 3.5b

Tribe	No. valid species	No. species in ISTC
Bathybatini	17	17 (100%)
Benthochromini	2	2 (100%)
Boulengerochromini	1	1 (100%)
Cyphotilapiini	2	2 (100%)
Cyprichromini	7	7 (100%)
Ectodini	32	32 (100%)
Eretmodini	4	4 (100%)
Greenwoodochromini	2	2 (100%)
Haplochromini	3	3 (100%)
Lamprologini	79	70 (89%)
Limnochromini	8	8 (100%)
Perissodini	9	9 (100%)
Tilapiini	4	4 (100%)
Tropheini	24	23 (96%)
Tylochromini	1	1 (100%)
New tribe	1	1 (100%)
Total	196	186 (95%)