THE MORPHOLOGY OF THE HEAD-MUSCLES OF A GENERALIZED HAPLOCHROMIS SPECIES: H. ELEGANS TREWAVAS 1933 (PISCES, CICHLIDAE)

by

G. CH. ANKER

(Zoologisch Laboratorium, Department of Morphology; State University of Leiden; Leiden; The Netherlands)

SUMMARY

This paper, dealing with the morphology (viz. structure, insertion areas, direction and, to a lesser degree, shape) of the head muscles of Haplochromis elegans, is the second study in a series on the head-morphology of this generalized Haplochromis species from the East-Africa Lakes Edward and George. The shape-descriptions of the skeletal elements, given in the first paper of the series (BAREL et al., 1976), have been used for an accurate definition of the position of the muscles. As well as dissection, graphical reconstructions from serial sections were necessary for an adequate description, especially of the small and complicated branchial muscles.

The aim of the series is a basic description of the head-morphology of a generalized Haplochromis species suitable for comparative studies on the functional morphology of cichlid fishes. Therefore the muscle-descriptions deal with aspects relevant to functional morphology and generally do not enter upon questions of formal comparative morphology, viz. homology and related subjects.

INTRODUCTION AND METHODS

This paper deals with a morphological description of the muscles in the head of Haplochromis elegans, a small cichlid fish from the East-African Lakes Edward and George. The paper is the second in a series describing the morphology of the muscle-skeleton-ligament system in the head of this generalized Haplochromis species. The first of the series deals with the shape of the skeletal elements (BAREL et al., 1976) and a third paper is planned to describe arthrology and ligaments. The series aims to provide an adequate basis for studies on the comparative functional morphology of the head of cichlid fishes (see BAREL et al., 1976 for a more detailed discussion). With this objective the following starting-points, underlying the present study, have been derived:

1. The description should include aspects of muscle-morphology relevant to a kinetic analysis of the muscle-skeleton-ligament system. Skeletal parts, muscles and ligaments, each represent a class of elements with distinct mechan-

1 Zoologisch Laboratorium; Kaiserstraat 63, Postbus 9516, 2300 RA Leiden, The Netherlands.
ical properties (cf. ANKER, 1974), e.g. muscles are the force providing elements. In a functional morphological study, the description of the muscle-morphology should, therefore, serve to determine the working lines and the size of the contraction-forces. This necessitates an accurate description of the areas of origo and insertion, and of the structure of the muscle. Shape is far less important for the kinetic study of muscles than it is for skeletal elements. The kinetic analysis is the first and important part of the functional morphology of the muscle-skeleton-ligament system but it should be followed by a study of the relation of this system to other systems such as sense-organs, nerves etc. ("pattern-analysis", DULLEMEIJER, 1974). In pattern-analysis, the shape of the muscles does play an important role (cf. DULLEMEIJER & BAREL, 1977; WITTE & BAREL, in press), e.g. the flattened shape of the m. adductor mandibulae probably cannot be deduced from the activities of the jaw-apparatus. However, this shape is well-understood in relationship to the narrow space available between the walls of the buccal "cylinder" and the external surface of the conically shaped head.

2. The description should be detailed enough to name those aspects of muscle-morphology which may differ in the various species. In cichlids, compared to many other fish families, the range of morphological variation is narrow. If a morphological description and nomenclature registers only the presence or absence of muscle or skeletal elements, no differences will be distinguishable. At this level, most probably nearly all cichlids will turn out to be similar. Morphological differences manifest themselves only with a more refined analysis: e.g.: in the structure of the muscles or in details of the surface-sculpture of skeletal elements. Therefore, a useful morphological description should be at the level of these differences.

Our studies on cichlid fishes deal with functional morphology, not with formal comparative anatomy. Consequently, in this paper, muscles are distinguished, lumped or subdivided in relation to their presumed (e.g. kinetic) significance and not on the basis of the homology-theories on fish-head musculature. Three examples may illustrate this principle:

(1) In the present paper, the musculus adductor mandibulae is conceived to be four muscles because almost no structural connections exist between the muscle "parts" A₁, A₂, A₃ and A₄ and because each of these "parts" inserts by a different tendon.

(2) The reverse holds for what has been called the "musculi obliqui ventralis" in this paper. Sections of these muscles may be homologous with the musculi transversi ventrales of other authors (see page 264).

(3) It may be argued that the rostral half of our musculus levator