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Revision of the western Indian Ocean fish subfamily Anisochrominae (Perciformes, Pseudochromidae)

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CONTENTS

SYNOPSIS. Monophyly of the Anisochrominae is supported by eight autapomorphies: ectopterygoid and mesopterygoid well separated from palatine; preopercle well separated from skull; dorsal insertion of posterior mandibulohyoid ligament; dentary not forked; medial origin of A_1 section of adductor mandibulae; high number of epineural bones; low number of circumpeduncular scales; and low number of lower-limb gill rakers. The subfamily includes a single genus, *Anisochromis*, with three species, which are distinguished on the basis of various meristic and male coloration characters: *A. kenyae* Smith from east Africa, the Comoros Islands and Madagascar; *A. mascarenensis* sp.nov. from Réunion and Mauritius; and *A. straussi* Springer, Smith and Fraser from Saint Brandon's Shoals.

INTRODUCTION

The family Anisochromidae was erected by Smith (1954) to accommodate a new genus and species, *Anisochromis kenyae*, from the east coast of Africa. He noted that the species exhibited pronounced sexual dichromatism, and proposed a close relationship of the new family to the Pseudochromidae. He distinguished the two families on the basis of differences in number of vertebrae, head scalation, number of lateral lines, gill membrane development, palatine dentition, fin spine development, fin-ray branching, number of pectoral-fin rays, and pelvic-fin position.

Springer *et al.* (1977) described a second species of *Anisochromis*, *A. straussi*, from Saint Brandon's Shoals (= Cargados Carajos) in the southwestern Indian Ocean, which they differentiated from *A. kenyae* on the basis of coloration and numbers of dorsal-fin rays, anal-fin rays, vertebrae and tubed lateral-line scales. They noted that the species is dimorphic, but that eggs were present in both colour forms. They therefore examined gonads of the species histologically, and concluded it is a protogynous hermaphrodite. They also investigated the systematic relationships of the Anisochromidae, and proposed that the family is the sister group of the Pseudoplesiopidae, and that the two families form a monophyletic group with the Pseudochromidae. They therefore synonymised the three families under the oldest available name, Pseudochromidae. They noted that *Anisochromis* possessed the following autapomorphies: dorsal- and anal-fin spines very weak (versus weak to strong); no scales on head (versus head scaled); palatine teeth absent (versus present); fewer than four gill rakers on lower limb of first gill arch (versus more than seven); branchiostegal membranes with ventroposterior margins fused across ventral surface of head (versus separate ventroposteriorly); ectopterygoid and mesopterygoid well separated from palatine (versus articulate closely with palatine); and ligament from (anterior) ceratohyal attaches to dentary on coronoid process (versus at symphysis).

Godkin & Winterbottom (1985) provided evidence for classification of the Congrogadidae, previously placed in the Blennioidei or Trachinoidei, in the Pseudochromidae as the sister group of *Anisochromis*. They relegated the Congrogadidae to subfamilial status, along with the Anisochrominae, Pseudochrominae and Pseudoplesiopinae. They identified a new autapomorphy for *Anisochromis* (A_1 section of the adductor mandibulae originates from the preopercle medial to the dorsolateral fibres of the A_2 section), but noted that several of those reported by Springer *et al.*

(1977) were also found in the Congrogadinae, and were thus synapomorphies of the two subfamilies: absence of palatine teeth; lower gill rakers fewer than seven; head scaleless or with scales confined to the cheek and/or operculum; and gill membranes fused.

In 1995, the first author and associates made collections of shorefishes from Mauritius. Included among the collections was a single specimen of an undescribed *Anisochromis*, which had a coloration pattern similar to *A. kenyae*, but with meristic characters more closely resembling *A. straussi*. A search of museum collections revealed a small juvenile specimen of the same species collected by J.E. Randall from the adjacent island of Réunion. In 1998, the second author made collections of shorefishes from the latter island, including nine specimens of the new species. However, he misidentified them as *A. kenyae* and recorded them as such in a checklist of the fishes of the Mascarene Islands (Fricke, 1999).

MATERIALS AND METHODS

Institutional codes follow Leviton *et al.* (1985). All measurements to the snout tip were made to the midanterior tip of the upper lip. Length of specimens are given in mm standard length (SL), which was measured from the snout tip to the middle of the caudal peduncle at the vertical through the posterior edge of the dorsal hypural plate. Head length was measured from the snout tip to the posteriormost edge of the opercular membrane. Snout length was measured over the shortest distance from the snout tip to the orbital rim, without constricting the fleshy rim of the latter. Orbit diameter was measured as its fleshy horizontal length. Interorbital width was measured as the least fleshy width. Upper jaw length was measured from the snout tip to the posterior edge of the maxilla. Predorsal, preanal and prepelvic lengths were measured from the snout tip to the base of the first spine of the relevant fin. Body width was measured between the posttemporal pores (Fig. 1). Caudal peduncle length was measured from the base of the last anal-fin ray to the ventral edge of the caudal fin at the vertical though the posterior edge of the ventral hypural plate. Caudal peduncle depth was measured obliquely between the bases of the last dorsal- and last anal-fin rays. Measurements of fin rays excluded any filamentous membranes. Pectoral fin length was measured as the length of the longest middle ray. Caudal fin length was measured as the length of the lowermost ray on the dorsal hypural plate.

The last ray in the dorsal and anal fins is divided at its base and was counted as a single ray. As in most actinopterygians, the uppermost ray in the pectoral fins is rudimentary and rotated so that the asymmetrical medial and lateral hemitrichia appear to represent two separate rays; these were counted as a single ray. Procurrent caudal-fin ray counts were of the rays above ('upper') and below ('lower') the principal caudal-fin rays. The uppermost principal caudal-fin ray was defined as the ray articulating with hypural 5, and the lowermost principal caudal-fin ray was the ray articulating with the cartilage nubbin between the distal tips of the parhypural and the haemal spine of preural centrum 2 (= post-haemal spine cartilage of PU2 following the terminology of Fujita, 1989). Counts of tubed scales in the anterior lateral lines included both intermittent non-tubed scales and empty scale pockets; if the scale following the last tubed scale in the anterior lateral line was missing, a value for the anterior lateral line count was not recorded. 'Scales in lateral series' was defined as the number of scales in the anterior lateral line plus the number of scales rows on the caudal peduncle, the latter count beginning with the transverse row following the last tubed scale in the anterior lateral line and finishing with the transverse row passing

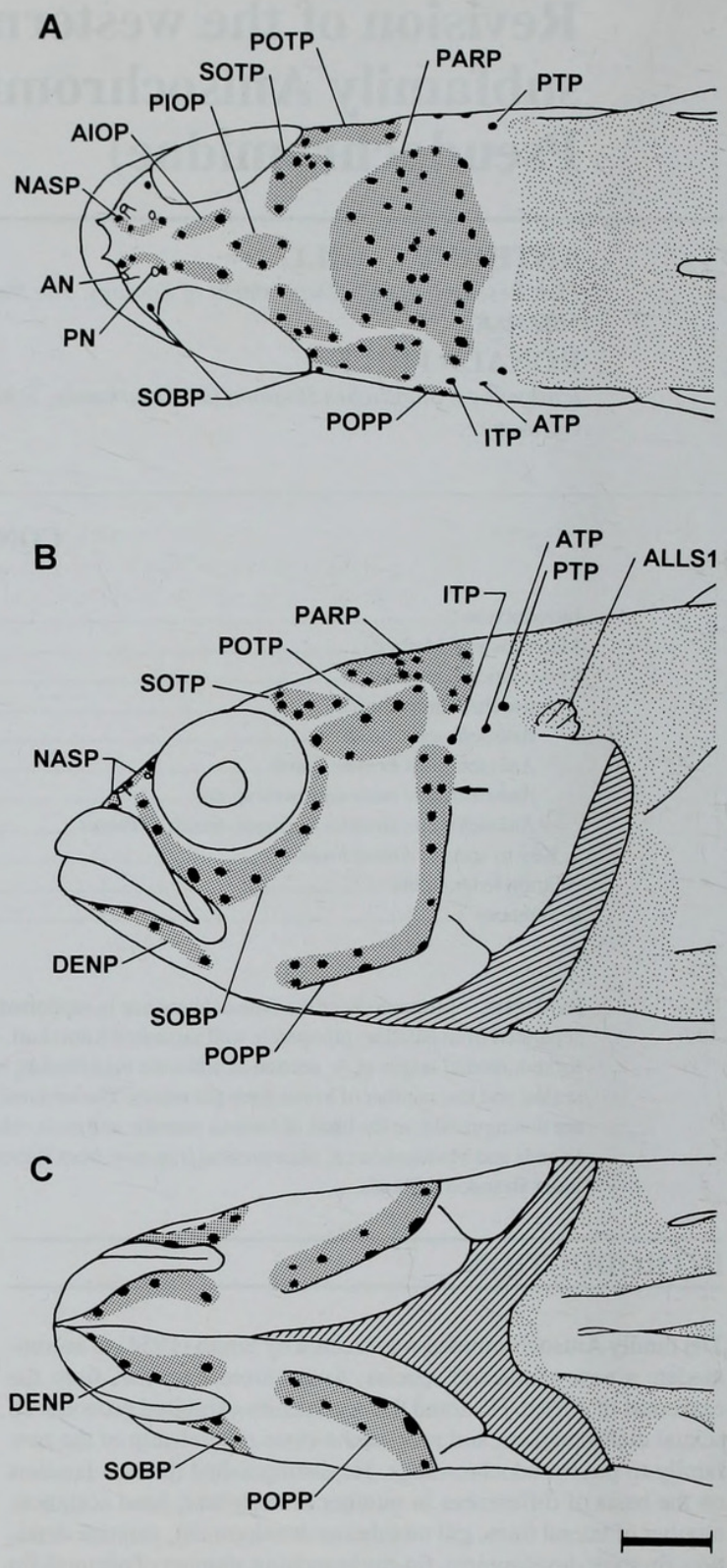

Fig. 1 Cephalic laterosensory pores of *Anisochromis mascarenensis*, SMNS 23037, 23.9 mm SL, male, holotype, Réunion, in A) dorsal, B) left lateral and C) ventral views. AIOP, anterior interorbital pores; ALLS1, first anterior lateral-line scale (shown only in B; other scales omitted); AN, anterior nostril; ATP, anterior temporal pore; DENP, dentary pores; ITP, intertemporal pores; NASP, nasal pores; PARP, parietal pores; PIOP, posterior interorbital pores; PN, posterior nostril; POPP, preopercle pores; POTP, posterior otic pores; PTP, posttemporal pore; SOBP, suborbital pores; SOTP, suprotic pores. Arrow indicates dorsal tip of preopercle; branchiostegal membranes shown hatched; scaled areas on body shown in manual stipple. Scale bar = 1 mm.

through the scale at the midposterior edge of the hypural plate. 'Scales in transverse series' were counted anterodorsally from the anal-fin origin to the dorsal-fin base and are presented in the form 'x + 1 + y = z' where 'x' is the number of scales between the anterior lateral line and the anal-fin origin, '1' is the anterior lateral-line scale, 'y' is the number of scales above the anterior lateral line to the dorsal-fin base, and 'z' is the total number of scales in the series. Scale-row number for the position of the first ctenoid scale was determined by aligning the scale along an anterodorsal scale row to the anterior lateral line, then recording the number (counting from the origin of the lateral line) of the tubed scale in that row. Gill-raker counts were of the outer rakers on the first arch; the angle raker is included in the lower-limb (second) count. Counts of pseudobranch filaments included all rudiments. Because counts of gill rakers and pseudobranch filaments could not be made without damaging the branchiostegal membranes, these were only made on a few specimens.

Nomenclature of cephalic laterosensory pores is clarified in Fig. 1, and follows Winterbottom (1986), except for the nomenclature of those of the posttemporal area, which follows Gill *et al.* (2000).

Vertebral counts are given in the form precaudal + caudal = total. Caudal vertebrae are defined as those with a haemal spine, and include the terminal urostylar complex (which was counted as a single vertebra). The pattern of insertion of supraneural (predorsal) bones and anterior dorsal-fin pterygiophores within interneural spaces is given as an 'anterior dorsal-fin pterygiophore formula' modified from the 'predorsal formula' of Ahlstrom *et al.* (1976). Each supraneural is represented by an 'S,' neural spines are represented by slashes, and pterygiophores are represented by '2' (indicating a pterygiophore that bears a supernumerary ray and a serially associated ray), or '1' (indicating a pterygiophore that bears only a serially associated ray). A superscript 'v' indicates where a supraneural bone was present only as a vestige. Parentheses enclose elements that may be absent. An 'anterior anal-fin pterygiophore formula' is also presented, where the slashes represent haemal spines. Epineural counts are of the intermuscular bones that have been traditionally identified as epipleural ribs by perciform workers; this terminology follows Johnson & Patterson (1993: 557, 'the bones conventionally called epipleurals in those fishes [atherinomorphs and perciforms and their relatives] are homologous with the epineurals, not the epipleurals, of non-acanthomorph fishes'). Posterior epineurals were often poorly ossified, and difficult to count accurately on radiographs; counts should therefore be considered approximate. Osteological features were determined from radiographs and from cleared-and-stained specimens, which were prepared following the methods of Taylor & Van Dyke (1985). Examination of ligaments was enhanced by transfer of cleared-and-stained specimens from glycerol to 70% ethanol.

We use the terms 'female' and 'male' in preference to 'ocellated phase' and 'terminal phase' of Springer *et al.* (1977). We appreciate, however, the deficiencies of this terminology. As noted by Springer *et al.*(p. 7) for *A. straussi*: 'specimens with ocellated stage colour pattern are smaller and generally females, and specimens with terminal stage colour pattern are larger and are males, but there is considerable overlap. The overlap is not surprising and is comparable to that found in other transforming hermaphrodites.'

Count and morphometric value ranges are given first for all specimens, followed, where variation was noted, by values for the holotype in parentheses; where bilateral counts were recorded from the holotype, both counts are given and separated from each other by a slash, the first count being the left count. Frequency distributions for selected meristic characters are summarised in Tables 1–11.

SYSTEMATICS

ANISOCHROMINAE SMITH, 1954

Anisochromidae Smith, 1954: 298.

Anisochromis Smith, 1954

Anisochromis Smith 1954: 298 (type species, *Anisochromis kenyae* Smith, 1954, by original designation and monotypy).

MONOPHYLY

The following eight autapomorphies diagnose *Anisochromis* as monophyletic:

1. *Ectopterygoid and mesopterygoid well separated from palatine.* In pseudochromines and pseudoplesiopines the palatine is loosely connected to the ectopterygoid via a short ligament and to the mesopterygoid via a short, narrow ribbon of cartilage. In congrogadines the palatine is closely applied, and often tightly bound, to the mesopterygoid; the ectopterygoid lacks an anterior process, and is disassociated from the dorsal part of the palatoquadrate (e.g., Godkin & Winterbottom, 1985: fig. 6; Gill *et al.*, 2000: fig. 3). In anisochromines the palatine is broadly separated from the ectopterygoid and mesopterygoid: the ectopterygoid is truncated anteriorly (though closely applied to the mesopterygoid), and lacks a ligamentous connection to the palatine; the mesopterygoid is connected to the palatine via a relatively long, broad, strap-like ligament (which lacks cartilage) (Fig. 2).
2. *Preopercle well separated from skull.* In congrogadines, pseudochromines and pseudoplesiopines the dorsal tip of preopercle is in close proximity to the skull, and the preopercular laterosensory canal communicates with the pterotic canal via a short membranous canal; the dorsal tip of the preopercle reaches to near the dorsal margin of the hyomandibula (e.g., Gill *et al.*, 2000: figs 1, 3). In anisochromines the preopercle is truncated dorsally, not reaching the dorsal margin of the hyomandibula (reaching to or slightly above the opercular process of the hyomandibula), and well-separated from the skull (Fig. 2); the preopercular laterosensory canal communicates with the pterotic canal via a relatively long membranous canal.
3. *Dorsal insertion of posterior mandibulohyoid ligament.* Springer *et al.* (1977) proposed that *Anisochromis* is autapomorphic in having a modified orientation of a cord-like ligament extending from the anterior ceratohyal to the dentary, from insertion near the symphysis (pseudochromines and pseudoplesiopines) to insertion on the coronoid process. However, we present a different interpretation of this character. There are actually two more-or-less cord-like ligaments connecting the dentary and anterior ceratohyal in anisochromines, pseudochromines and pseudoplesiopines. [We use the general term 'mandibulohyoid' for these ligaments following Greenwood (1995), though we do not intend to imply homology with the mandibulohyoid ligaments of lower teleosts.] The first of these extends from the medial or dorsal surface of the anterior ceratohyal, in the vicinity of a dorsal notch in the bone (possibly homologous with the beryciform foramen of McAllister, 1968), to the dentary symphysis. The second mandibulohyoid ligament extends from the lateral surface of the anterior ceratohyal at a point just anterior to the anterior/posterior ceratohyal suture to either the posterior end of the ventral process (pseudochromines and pseudoplesiopines)

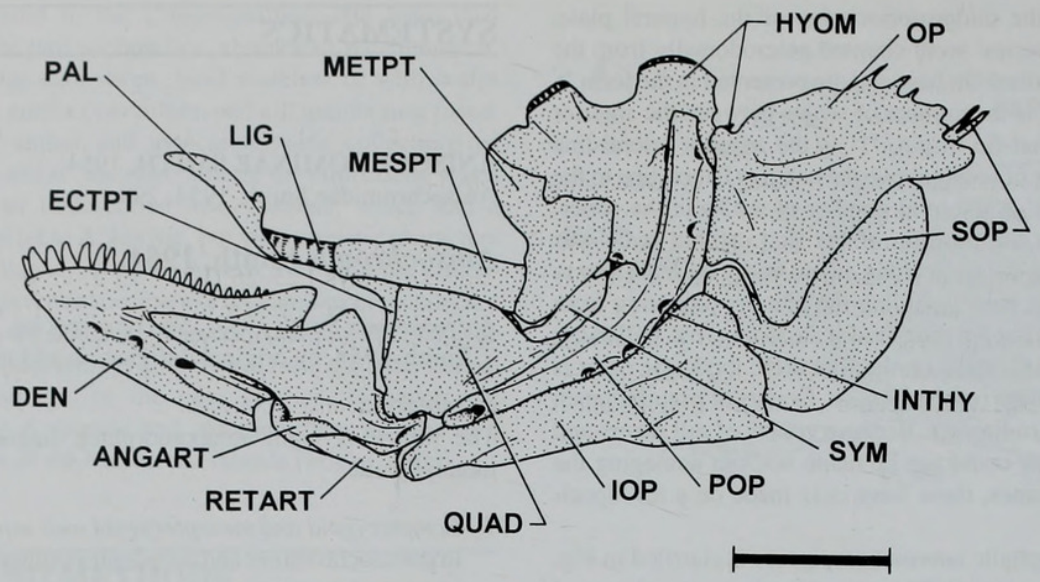

Fig. 2 Lateral view of lower jaw and suspensorium of *Anisochromis kenyae*, RUSI 4906, 23.3 mm SL, right side reversed. ANGART – angularticular; DEN – dentary; ECTPT – ectopterygoid; HYOM – hyomandibula; INTHY, interhyal; IOP, interopercle; LIG – ligament between palatine and mesopterygoid; MESPT, mesopterygoid; METPT, metapterygoid; OP, opercle; PAL, palatine; POP, preopercle; QUAD, quadrate; RETART, retroarticular; SOP, subopercle; SYM, symplectic. Cartilage shown in coarse stipple. Scale bar = 1 mm.

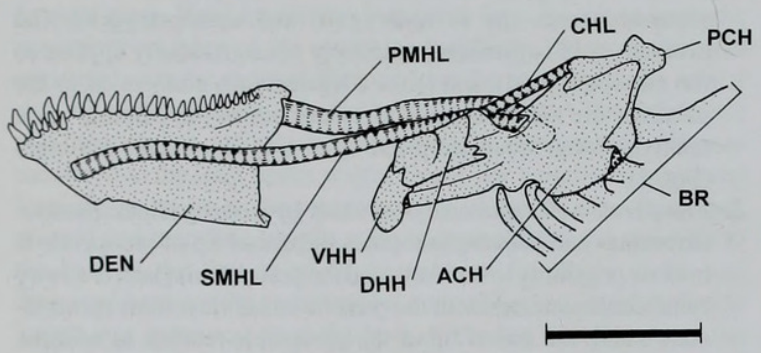

Fig. 3 Medial view of right side dentary and hyoid bar with associated ligaments of *Anisochromis kenyae*, RUSI 4906, 23.3 mm SL. ACH, anterior ceratohyal; BR, branchiostegal rays; CHL, ligament extending between posterior and anterior ceratohyals; DEN, dentary; DHH, dorsal hypohyal; PCH, posterior ceratohyal; PMHL, posterior mandibulohyoid ligament (portion obscured by anterior ceratohyal shown in broken lines); SMHL, symphyseal mandibulohyoid ligament; VHH, ventral hypohyal. Cartilage shown in coarse stipple. Scale bar = 1 mm.

or the coronoid process (anisochromines) of the dentary (Fig. 3). We interpret this change in orientation as an autapomorphy of the Anisochrominae. Although the former (symphyseal) ligament is well-developed in congrogadines examined by us (including species of *Blennodesmus* Günther, *Congrogadus* Günther, *Halidesmus* Günther and *Haliophis* Rüppell) and in the basalmost genus *Rusichthys* Winterbottom (R.D. Mooi, pers. comm.), the latter (posterior) ligament is apparently absent (which may thus represent a synapomorphy of the Congrogadinae).

4. *Dentary not forked.* In congrogadines, pseudochromines and pseudoplesiopines, the dentary is distinctly forked posteriorly, with a relatively narrow lamina of bone connecting the prominent coronoid and ventral processes; this condition is typical of perciform fishes. In anisochromines, the coronoid and ventral processes are united by a broad lamina of bone, so that the posterior margin of the dentary is weakly concave to almost vertical (Figs 2, 3).
5. *Medial origin of A1 section of adductor mandibulae.* In pseudochromines, pseudoplesiopines and most congrogadines, a strap-like A_1 section of the adductor mandibulae originates from the vertical limb of the preopercle, overlying other cheek musculature (Godkin & Winterbottom, 1985: figs 1A, 1B, 1C, 2A and 2B). In some derived congrogadines, the A_1 section is fused to the A_2 section (Godkin & Winterbottom, 1985: fig. 2C). Anisochromines have a strap-like A_1 section, but it originates on the vertical limb of the preopercle medial to the dorsolateral fibres of the A_2 section (Godkin & Winterbottom, 1985: fig. 1D).
6. *High number of epineural bones.* Epineural bones are present on all precaudal vertebrae, and, depending on species, on caudal vertebrae 1 through 2–8 in pseudochromines and pseudoplesiopines (Gill, in press; Gill & Edwards, in press). Taken in the context of Gill's (1998) interpretation of intermuscular homology in congrogadines, Godkin & Winterbottom's (1985) descriptions indicate that, depending on species and specimen size, epineural bones may be confined to the first few precaudal vertebrae, or 'present as far back as the first few caudal vertebrae' in congrogadines. In anisochromines, epineural bones are present on all precaudal vertebrae, extending posteriorly on to the first 10–17 caudal vertebrae.
7. *Low number of circumpeduncular scales.* Depending on species, pseudochromines and pseudoplesiopines usually have 16 or more circumpeduncular scales; although two pseudochromine species (*Cypho zaps* Gill and *Pseudochromis striatus* Gill, Shao and Chen) may have as few as 14 circumpeduncular scales, the modal count for both is 16 (Gill, in press). Circumpeduncular counts are not obtainable in congrogadines, as the dorsal and anal fins are confluent with the caudal fin (fin condition not determined for the basal congrogadine *Rusichthys plesiomorphus* Winterbottom, but confluent in its congener *R. explicitus* Winterbottom; Winterbottom, 1996); nevertheless, congrogadines have numerous, small scales on the caudal peduncle. In anisochromines, the scales on the caudal peduncle are relatively large, with only 12–14, modally 12, circumpeduncular scales.
8. *Low number of lower-limb gill rakers.* Numbers of outer rakers on the lower limb of the gill arch (those on ceratobranchial 1 –

including the so-called angle raker – and hypobranchial 1) range from 9–17 in pseudochromines, 6–20 in pseudoplesiopines, and 5–15 in congrogadines. Anisochromines only have 2–3 lower-limb rakers, although 1–2 very tiny rudiments may be present ventral to these; all rakers and rudiments are restricted to the upper part of ceratobranchial 1. A low number of lower-limb rakers was initially proposed as a character of Anisochrominae (as Anisochromidae) by Smith (1954), and cladistically interpreted as an autapomorphy of the taxon by Springer *et al.* (1977). It was later rejected as an autapomorphy of Anisochrominae by Godkin & Winterbottom (1985) and interpreted instead as a synapomorphy of the Anisochrominae + Congrogadinae. This interpretation is problematic because counts for congrogadines broadly overlap those of pseudoplesiopines. In any case, lower-limb gill-raker counts for anisochromines are lower than has been observed in any congrogadines (some descriptions give counts as low as 4 for certain congrogadine species, but these exclude the angle raker), and we therefore interpret the very low number of lower-limb rakers in anisochromines as autapomorphic.

ADDITIONAL DIAGNOSTIC CHARACTERS

Additional characters useful in distinguishing anisochromines from other pseudochromids are the following: dorsal-fin rays I,25–27, all or all but first segmented rays branched; anal-fin rays I,17–19, all segmented rays branched; pectoral-fin rays 13–15; pelvic-fins rays I,4, medial ray small, inconspicuous and unbranched, all other segmented rays branched; caudal-fin rays 4–6 + 8 + 8 + 3–5 = 23–27; vertebrae 10 (rarely 11) + 22–25; head without scales (predorsal scales extending anteriorly to point ranging from about 2/3 distance from dorsal origin to parietal commissure, to just short of parietal commissure; Fig. 1); lateral line represented on body by anterodorsal series of 28–39 tubed scales, and posterolateral series of centrally pitted scales; parietal pores relatively numerous (total pores 13–44), in continuous or almost continuous series over top of head; lower lip complete (uninterrupted at symphysis) with deep symphyseal notch; branchiostegal (gill) membranes broadly united, but free from isthmus (Fig. 1); fin spines weak and flexible; and anterior dorsal-fin pterygiophore formula S/S/(S^{v} or S) + 2/1 + 1.

REMARKS

We here consider the gender of *Anisochromis* to be feminine, in keeping with the accepted gender of *Chromis* [see Opinion 1417 (International Commission on Zoological Nomenclature, 1986) for ruling on the gender of *Chromis*]. Without explanation, Eschmeyer & Baily (1990: 29) gave the gender of *Anisochromis* as masculine; presumably their conclusion of masculine gender relates to the proposal by Bailey *et al.* (1980) to have all generic names ending in *-chromis* to be ruled as masculine.

ETYMOLOGY

The generic name is a combination of the Greek *anisos*, meaning 'unequal' or 'different,' and *Chromis*, a genus of pomacentrid fish. Gender is feminine (see *Remarks* above).

Anisochromis kenyae Smith, 1954

African Annie

Figs 2–7, 8A; Tables 1–11

Anisochromis kenyae Smith, 1954: 300, fig. 1, pl. 6 [Type locality: Malindi, Kenya; holotype RUSI 149].–Smith, 1977: 22, pl. 4C, D [taxonomic notes; range extension; colour illustrations].–Springer *et al.*, 1977: 5, fig. 1c [comparison].–Wheeler, 1985: 113 [compilation; text fig.].–Smith, 1986: 539, pl. 46, fig. 169.1A–B [compilation; colour illustrations].–Gill, 1998: fig. 5 [osteological details].–Gill & Edwards, 1999: fig. 8A [osteological details].

DIAGNOSIS

The following characters distinguish *A. kenyae* from congeners: dorsal-fin rays I,25–26, usually I,25; anal-fin rays I,17–18, usually I,17; caudal vertebrae 2224, usually 23; scales in lateral series 37–44, usually 38–41; and anterior lateral-line scales 28–35, usually 30–34.

DESCRIPTION (based on 46 specimens, 13.8–25.6 mm SL)

Dorsal-fin rays I,25–26 (I,25), all or all but first segmented rays branched (all branched in holotype); anal-fin rays I,17–18 (I,17), all segmented rays branched; pectoral-fin rays 13–15 (14/14), upper 1–2 (1/1) and lower 0–1 (1/1) rays simple; pelvic-fin rays I,4, medial ray small, inconspicuous and unbranched, all other segmented rays branched; upper procurrent caudal-fin rays 4–6 (5); lower procurrent caudal-fin rays 4–5 (4); principal caudal-fin rays 8 + 8, upper 0–1 (0) and lower 0–2 (0) unbranched; total caudal-fin rays 24–27 (25); scales in lateral series 37–44 (38/38); anterior lateral-line scales 28–35 (31/32); anterior lateral line terminating beneath segmented dorsal-fin ray 17–21 (20/21); predorsal scales 4–8 (6); scales in transverse series 10–13 + 1 + 2–3 = 14–17 (10 + 1 + 2/10 + 1 + 2); circumpeduncular scales 12–13; gill rakers 1–2 + 2–3 = 3–5, sometimes with 1–2 tiny rudiments (inconspicuous ossifications bearing a few or no teeth) above and below rakers (gill raker count not determined in holotype); pseudobranch filaments 6–7 (not determined in holotype).

Cephalic laterosensory pores (all bilaterally paired, unless otherwise stated): nasal pores 2–3 (2/2); anterior interorbital pores 2–3 (2/2); posterior interorbital pores (unpaired) 1–5 (2); supraotic pores 2–6 (5/3); suborbital pores 9–14 (10/10); posterior otic pores 1–7 (5/5); preopercular pores 8–17 (17/15); dentary pores 3–4 (4/4); intertemporal pores 1–2 (1/1); anterior temporal pores 0–1 (1/1); posttemporal pores 1–2 (2/1); total parietal pores 13–43 (36).

As percentage of standard length (based on 21 specimens, 18.5–24.5 mm SL): body depth at dorsal-fin origin 19.6–23.0 (22.5); greatest body depth 20.8–24.4 (23.0); head width 11.8–14.1 (14.1); head length 25.5–28.5 (28.2); snout length 4.6–5.6 (4.7); orbit diameter 7.1–8.7 (8.5); interorbital width 3.2–4.9 (4.2); upper jaw length 8.4–10.3 (10.3); caudal peduncle depth 13.0–15.5 (15.5); caudal peduncle length 8.0–10.6 (8.0); predorsal length 29.5–32.9 (32.9); preanal length 49.7–54.1 (54.0); prepelvic length 22.1–26.3 (26.3); first segmented dorsal-fin ray length 5.5–10.9 (9.4); third-from-last segmented dorsal-fin ray length 12.2–15.9 (14.1); dorsal-fin base length 60.5–66.5 (62.0); first segmented anal-fin ray length 5.6–10.0 (5.6); third-from-last segmented anal-fin ray length 12.9–14.8 (13.6); anal-fin base length 34.3–40.4 (37.1); caudal-fin length 19.6–22.6 (21.6); pectoral-fin length 17.3–21.7 (18.8); pelvic-fin length 12.9–17.4 (15.0).

Lower lip complete with deep symphyseal notch; fin spines weak and flexible; anterior dorsal-fin pterygiophore formula S/S/(S^{v} or S) + 2/1 + 1 (S/S/2/1 + 1); 20–23 (22) consecutive dorsal-fin pterygiophores inserting in 1:1 relationship directly behind neural spine 4; anterior anal-fin pterygiophore formula 2/1 + 1 or /2 + 1 + 1 (2/1 + 1); 12–15 (14) consecutive anal-fin pterygiophores inserting in 1:1 relationship directly behind haemal spine 2; fourth segmented pelvic-fin ray longest; caudal fin rounded; ctenoid scales beginning at 1–7 (not determined for holotype) transverse scale rows behind branchial opening; dorsal and anal fins without distinct scale sheaths, though often with intermittent scales overlapping fin bases; intermittent series of centrally pitted scales originating on midside above anterior part of anal fin, extending posteriorly along caudal peduncle to middle part of caudal-fin base; additional 1–3 centrally pitted scales present above and below pitted scale(s) on middle part of caudal-fin base; cheeks, operculum and upper part of

head without scales; predorsal scales extending anteriorly to point ranging from about 2/3 distance from dorsal origin to parietal commissure, to just short of parietal commissure; vertebrae 10 + 22–24 (10 + 22); epurals 2; epineurals present on vertebrae 1 through 20–23 (21); pleural ribs present on vertebrae 3 through 10, the ultimate rib small to moderately developed.

Upper jaw with 3 or 4 (at symphysis) to 1 or 2 (on sides of jaw) irregular rows of small conical teeth, those of outer row much larger; lower jaw with 2 or 3 (at symphysis) to 1 (on sides of jaw) rows of small conical teeth, those of outer row much larger; vomer with 1 or 2 rows of small conical teeth arranged in chevron; palatines edentate; tongue edentate and moderately pointed.

LIVE COLORATION

Males (based on the description in Smith, 1954: 302, the colour illustration in Smith, 1977: pl. 4D, and a photograph of a specimen from the Comoros Islands, ROM 56501, 22.1 mm SL): head bright reddish orange to bright red, with black-edged white stripe extending from posterodorsal rim of orbit, above upper part of preopercle, to upper edge of operculum; white spot on posteroventral rim of orbit at about 3 o'clock position; narrow brown to dark grey bar extending from ventral part of orbital rim to posterior edge of maxilla; iris yellow, red centrally, with radiating brown bars; nape dark brownish red to dark grey, with scattered small white spots; body black, with scattered small white spots, these sometimes aligning to form vague bars on upper part of body; dorsal fin with large dark grey to black spot, extending from first segmented ray to about fourth or fifth segmented ray; black spot bordered anteriorly with yellow, basally with bright yellow to bright orange, and sometimes posteriorly with yellow to bright orange; basal one-third of dorsal fin behind large black spot bright red, with small black spot or streak at base of each of fin ray, these sometimes edged anteriorly with white; remainder of dorsal fin reddish or pinkish hyaline to bright red, with greyish hyaline to grey distal margin; basal one-third of anal fin bright red, with small black spot or streak at base of each of fin ray, these sometimes edged anteriorly with white; remainder of anal fin reddish or pinkish hyaline to bright red, with greyish hyaline to grey distal margin; caudal fin black basally, remainder of fin greyish hyaline to black; pectoral fin black with irregular white spots basally, remainder of fin greyish hyaline, with fin rays dark grey; pelvic fin bright yellow on base, remainder of fin black, sometimes with distal margin pale grey to hyaline. Females (based on the description in Smith, 1954: 302, the colour illustration in Smith, 1977: pl. 4C, and a photograph of a specimen from the Comoros Islands, ROM 56502, 22.7 mm SL): head olive-brown to brown dorsally, becoming pale green ventrally, with two pale olive bars on nape; large dark grey to black spot on subopercle, bordered irregularly with white, sometimes with additional, smaller white-edged black spot on lower part of subopercle; brown-edged diffuse pale olive stripe extending from posterodorsal rim of orbit, above upper part of preopercle, to upper edge of operculum; two white spots or clusters of white to mauve spots on posteroventral rim of orbit, at about 3 and 5 o'clock positions; head and nape with scattered white to mauve or pale olive small spots; narrow dark brown to grey bar extending from ventral part of orbital rim to posterior edge of maxilla; iris pale yellow to pale orange, with radiating brown bars; body generally orange-brown, becoming olive to dusky green posteriorly; body with olive-brown bars, alternating with pale olive bars; pale olive bars sometimes dotted with pale green to mauve spots; broad orange-yellow area sometimes present on side of body; upper and lower edges of caudal peduncle sometimes with small, punctate black spots; dorsal and anal fins dusky green to dusky orange or greenish hyaline, often with

Fig. 4 *Anisochromis kenyae*, ROM 56711, 21.6 mm SL, male, Comoros Islands (Photograph by P. Hurst).

irregular pale olive to mauve or white small spots; barring on body sometimes extending slightly on to fin bases; base of each ray in dorsal and anal fins sometimes with small reddish brown to black spot or streak, edged anteriorly with pale olive to mauve or white; caudal fin olive to lime green basally, remainder of fin dusky olive to dusky orange or hyaline; fleshy pectoral-fin base maroon to dark brown, with scattered white to mauve spots; pectoral fin orangish hyaline to hyaline; pelvic fin olive, sometimes with base pale yellow.

PRESERVED COLORATION

Males (Figs 4, 8A): pattern generally similar to live coloration, head and anterior part of body becoming pale brown, paler ventrally; pale markings on head obsolete; dark spots and stripes on head remain, becoming dark grey-brown to dark brown; body behind pectoral-fin base dark grey-brown; white spots and bars on body remain, becoming brownish white to pale yellow; dorsal and anal fins brownish white, sometimes dusky hyaline distally, with dark grey-brown spots often present at base of each fin ray; large dark spot at anterior of dorsal fin remains, becoming dark grey-brown; caudal fin dark grey-brown basally, dusky hyaline to brown distally; pectoral fin grey-brown basally, dusky hyaline to hyaline on remainder of fin; pelvic fin brownish white to pale yellow basally, sometimes slightly darker on extreme base, remainder of fin dark grey-brown to brown, often with distal margin narrowly pale brown. Females (Fig. 5): pattern generally similar to live coloration, head and body becoming pale brown; pale markings on head and body obsolete; dark spots and stripes on head remain, becoming dark grey-brown to dark brown (ocellated spots sometimes absent, although possibly these represent intermediately coloured, sex-transforming specimens), sometimes with additional irregular brown vermiform markings and spots on cheek and operculum; dark barring on head and body variably remains, becoming brown to pale brown; dark punctate spots on caudal peduncle remain, becoming dark brown to dark grey-brown, sometimes extending anteriorly to near middle of dorsal- and anal-fin bases; dorsal and anal fins dusky brown to

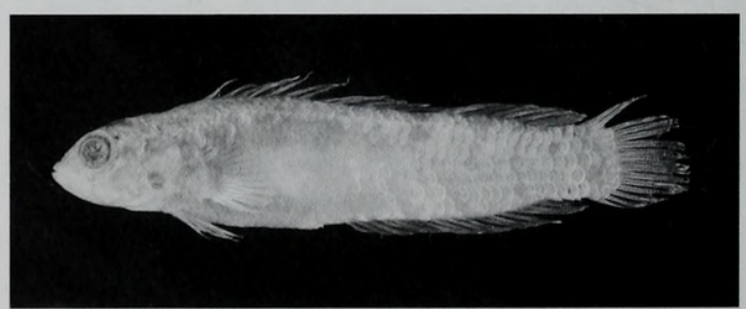

Fig. 5 *Anisochromis kenyae*, ROM 56502, 22.7 mm SL, female, Comoros Islands (Photograph by P. Hurst).

brownish hyaline, often with irregular pale brown small spots; barring on body sometimes extending slightly on to fin bases; caudal fin brown to grey brown, remainder of fin dusky brown to brownish hyaline; fleshy pectoral-fin base brown, with indistinct scattered pale spots; pectoral fin brownish hyaline to hyaline; pelvic fin dusky brown to brownish hyaline, sometimes paler ventrally, usually pale brown to hyaline distally.

HABITAT AND DISTRIBUTION

Anisochromis kenyae is known only from the east coast of Africa (Kenya to northern Mozambique), the Comoros Islands and northern Madagascar (Fig. 6). As noted above, Fricke's (1999) record of the species from Réunion is based on specimens of *A. mascarenensis*. According to Smith (1954: 302), type specimens of *A. kenyae* were collected from coastal 'pools in reefs at about low-tide mark' and that they were 'not uncommon at some localities.' Data accompanying subsequently collected specimens indicate that the species also occurs on reef crests and in shallow subtidal reef areas to depths of at least 3 m.

COMPARISONS WITH OTHER SPECIES

The three species of *Anisochromis* differ from each other in the following meristic characters: segmented dorsal-fin rays (modally 25 in *A. kenyae* versus modally 26 in *A. mascarenensis* and *A. straussi*; Table 1); segmented anal-fin rays (modally 17 in *A. kenyae* versus modally 18 in *A. mascarenensis* and *A. straussi*; Table 1); caudal vertebrae (modally 23 in *A. kenyae* versus modally 24 in *A. mascarenensis* and *A. straussi*; Table 3); scales in lateral series (37–44, usually 38–41 in *A. kenyae* versus 40–45, usually 41–44 in *A. mascarenensis* and *A. straussi*; Table 5); anterior lateral-line scales (28–35, usually 30–34 in *A. kenyae* versus 32–39, usually 33–37 in *A. mascarenensis* and *A. straussi*; Table 6); posterior interorbital pores (1–5, usually 2–4 in *A. kenyae*, 3–4 in *A. mascarenensis*, and 1–2 in *A. straussi*; Table 11); and total parietal pores (usually more numerous in *A. kenyae* and *A. mascarenensis* than in *A. straussi*; Fig. 7).

The three species are also distinguished on the basis of preserved male coloration. The dorsal and anal fins of *A. kenyae* and *A. mascarenensis* males are generally pale (mostly red in life), with a large dark spot distally on the anterior part of the dorsal fin (Figs 4, 9). In contrast, the dorsal and anal fins of *A. straussi* males are generally dusky to black (in life and in preservative), with at most an indistinctly darker marking basally on the anterior part of the dorsal fin (Fig. 12). Probable intermediate-phase (sex-changing) specimens of *A. mascarenensis* have mostly dusky dorsal and anal fins (Fig. 11) and thus might be confused with males of *A. straussi*. However, they bear the characteristic large dark spot distally on the anterior part of the dorsal fin. The pelvic fins of *A. kenyae* and *A. mascarenensis* males are broadly pale on the basal part of the fin (though sometimes slightly darker or dappled with darker spots on the basalmost portion of the fin) and abruptly dark distally, sometimes with a pale distal margin (Figs 8A–B). In *A. straussi* males the pelvic fins are mostly dusky, although sometimes with a narrow pale basal area, with a pale distal margin (Fig. 8C). The bodies of *A. kenyae* and *A. mascarenensis* males have relatively conspicuous pale spots, whereas in *A. straussi* males pale spots are either absent, or inconspicuous and confined to the anterodorsal part of the body.

REMARKS

Fourmanoir (1957: 246) recorded an unidentified specimen of *Anisochromis* from Bimbini, Anjouan, Comoros Islands. Based on distribution, it would appear that his specimen, which could not be located for this study, is referable to *A. kenyae*. However, there is reason to question the generic identity of the specimen. Although Fourmanoir gave a dorsal-fin ray count of I,25, which is characteristic of *A. kenyae* – as perhaps is his count of '35 rangées d'écailles' (= scales in lateral series?) – his counts of anal-fin rays (I,14) and lateral-line scales (20) are well outside those known for any species of *Anisochromis*.

MATERIAL EXAMINED

KENYA: Shimoni, Kisiti Islands, J.L.B. & M.M. Smith, 1 November 1952, RUSI 854, 14: 17.5–25.0 mm SL (paratypes; x-radiographs only), USNM 216415 (out of RUSI 854), 6: 21.7–24.5 mm SL (paratypes); Malindi, Sail Rock channel, J.L.B. & M.M. Smith, 11 October 1952, RUSI 149, 1: 21.3 mm SL (holotype); Shimoni, J.L.B. and M.M. Smith, 27 August 1954, RUSI 4905, 3: 22.3–23.9 mm SL. TANZANIA: north-east corner of Lathan Island (06°54'05"S 039°55'43'E), rocky shore, Anton Bruun Cruise 9, Station HA-6, 20 November 1964, ANSP 134469, 1: 25.6 mm SL (x-radiograph only). MOZAMBIQUE: Pinda Reef, J.L.B. and M.M. Smith, 3 September 1956, RUSI 4906, 7: 21.6–25.0 mm SL (1: 23.3 mm SL, subsequently cleared and stained; 2: 24.0–25.0 mm SL, x-radiographs only). COMOROS ISLANDS: Moheli, reef crest off middle of bay at north-east tip of Ouenefou Island (12°23'25"S 043°42'330"E), occasional live corals (*Acropora*, *Pocillopora* and *Porites*), algae covered rubble, calcareous rock and occasional sand patches, 0–1 m, R. Winterbottom *et al.*, 22 November 1988 (field number RW 88-29), ROM 56502, 9: 13.8–22.7 mm SL; Anjouan, Point Chongochahari, headland north and east of village of M'Jamaoue (12°11'09"S 044°19'03"E), vertical coral-rock walled gully with sandy floor, small caves and crevices, and some live hard corals (*Acropora* and *Pocillopora*), 3–9 m, R. Winterbottom *et al.*, 21 November 1988 (field number RW 88-28), ROM 56711, 1: 21.6 mm SL; Mayotte, north coast of Isle Malandzamiayatsini near eastern tip (12°40'19"S 044°03'27"E), reef top, profuse soft and hard corals (*Acropora*, *Pocillopora*, *Porites* and lettuce coral), with some calcareous rock and sand gullies, 0–4 m, W. Holleman *et al.*, 16 November 1988 (field number RW 88-17), ROM 56501, 2: 22.1–23.0 mm SL. MADAGASCAR: Nosy Bé, Andilana Beach, 100 m west of hotel, 50 m offshore (14°43'S 050°57'E), around coral bommies on sand flat with turtle grass, 0.3–2.5 m, J. Paxton, B. Collette, D. Cohen, E. Anderson, J. Nielsen and K. Sulak, 9 November 1988, AMS I.28113-064, 2: 13.9–22.1 mm SL.

Anisochromis mascarenensis sp.nov.

Mascarene Annie

Figs 1, 6, 7, 8B, 9–11; Tables 1–11

Anisochromis kenyae [*non* Smith, 1954].– Fricke, 1999: 214 [Réunion].

Holotype, SMNS 23037, 23.9 mm SL, Réunion, west coast, Les Filaos, L'Hermitage-les-Bains, 11 km south-west of St-Paul, 21°06'16"S 055°12'38"E, lagoon reef with live corals, 0–0.5 m (low tide), R. Fricke, 19 December 1998.

Paratypes, BMNH 2001.3.8.2, 23.3 mm SL (subsequently cleared and stained), collected with holotype; BPBM 16277, 1: 13.3 mm SL, Réunion, Cap Houssaye, sand and coral knoll, 12–18 m, J.E. Randall, 27 October 1973; MNHN 2001-494, 24.1 mm SL, collected with holotype; SMNS 20933, 2: 19.7–25.5 mm SL, Réunion, west coast, Les Filaos, L'Hermitage-les-Bains, 11 km south-west of St-Paul, 21°06'16"S 055°12'38"E, lagoon reef with dead and live corals, 0–0.5 m (at extremely low tide), R.Fricke, 18 December 1998; SMNS 21025, 4: 19.7–25.2 mm SL, collected with holotype; USNM 364534, 19.6 mm SL, Mauritius, north coast, Grande Gaube, lagoon reef

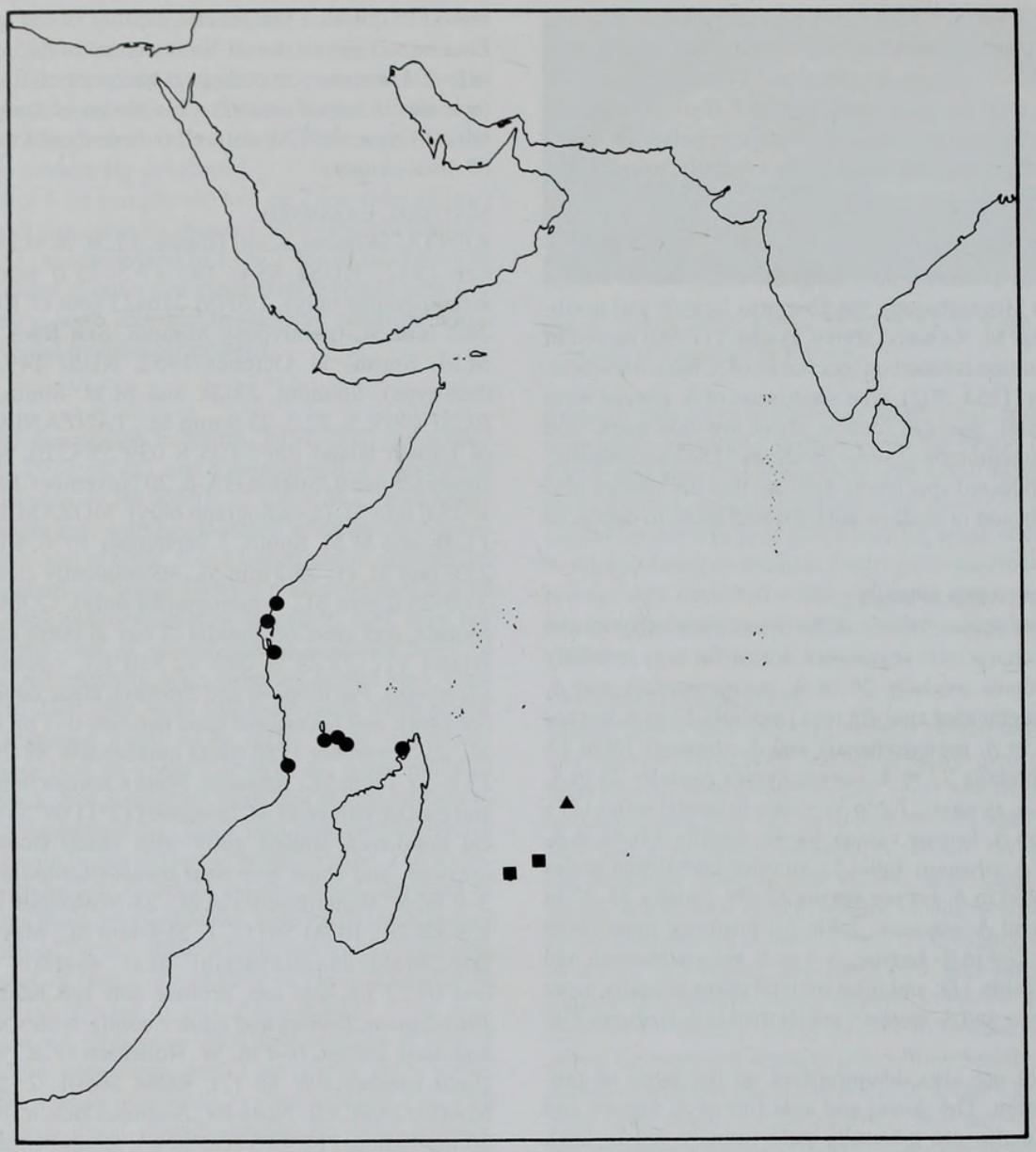

Fig. 6 Distributional records for *Anisochromis kenyae* (●), *A. mascarenensis* (■) and *A. straussi* (▲).

with dead and live corals, 3–4 m, P.C. Heemstra, A.C. Gill, M. Smale, W. Holleman, P. Clark and B. Galil, 16 May 1995 (field number PCH 95-M28).

DIAGNOSIS

The following characters distinguish *A. mascarenensis* from congeners: dorsal-fin rays I,25–26, usually I,26; anal-fin rays I,17–18, usually I,18; caudal vertebrae 23–24, usually 24; scales in lateral series 40–45, usually 42–44; posterior interorbital pores 34; total parietal pores 23–44, usually more than 30; dorsal fin of male specimens pale in preservative, with conspicuous, large dark spot distally on anterior part of fin.

DESCRIPTION (Based on 11 specimens, 13.3–25.5 mm SL)

Dorsal-fin rays I,25–26 (I,26), all segmented rays branched; anal-fin rays I,17–18 (I,18), all segmented rays branched; pectoral-fin rays 13–14 (13/14), upper 1 and lower 0–1 (0/1) rays simple; pelvic-fin rays I,4, medial ray small, inconspicuous and unbranched, all other segmented rays branched; upper procurrent caudal-fin rays 5; lower procurrent caudal-fin rays 4–5 (4); principal caudal-fin rays 8 + 8, upper 0–1 (0) and lower 0–1 (0) unbranched; total caudal-fin rays 25–26 (25); scales in lateral series 40–45 (43/43); anterior lateral-line scales 32–39 (35/35); anterior lateral line terminating beneath segmented dorsal-fin ray 19–23 (21/21); predorsal scales 5–6 (5); scales in transverse series 10–12 + 1 + 2–3 = 13–16 (11 + 1 + 2/11 + 1 + 2); circumpeduncular scales 12; gill rakers 1–2 + 2, sometimes with 1–2 tiny rudiments (inconspicuous ossifications bearing a few or no teeth) above and below rakers (gill raker count not determined in holotype); pseudobranch filaments 6–7 (not determined in holotype).

Cephalic laterosensory pores (all bilaterally paired, unless otherwise stated; Fig. 1): nasal pores 1–3 (3/3); anterior interorbital pores 2–3 (2/2); posterior interorbital pores (unpaired) 3–4 (3); supraotic pores 2–6 (5/6); suborbital pores 8–13 (10/10); posterior otic pores 4–10 (6/5); preopercular pores 12–18 (13/15); dentary pores 3–4 (4/4); intertemporal pores 1–2 (1/1); anterior temporal pores 1–2 (1/1); posttemporal pores 1–2 (1/1); total parietal pores 23–44 (35).

As percentage of standard length (based on nine specimens, 19.6–25.5 mm SL): body depth at dorsal-fin origin 18.7–20.8 (19.2); greatest body depth 18.7–20.8 (19.2); head width 11.5–13.3 (11.7); head length 25.2–27.4 (25.9); snout length 4.5–5.6 (5.0); orbit diameter 6.7–8.7 (7.1); interorbital width 3.3–4.1 (3.3); upper jaw

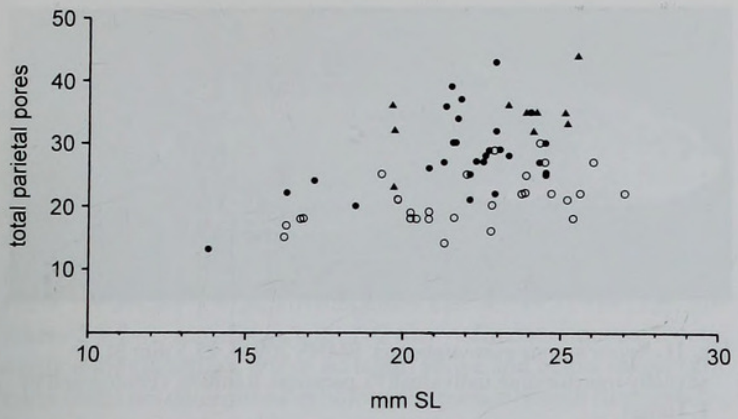

Fig. 7. Total counts of parietal pores plotted against SL for specimens of *Anisochromis kenyae* (●), *A. mascarenensis* (▲) and *A. straussi* (○).

length 8.6–9.8 (9.6); caudal peduncle depth 12.0–13.7 (13.0); caudal peduncle length 8.7–10.5 (10.5); predorsal length 28.9–31.1 (28.9); preanal length 49.6–53.9 (50.2); prepelvic length 21.2–25.5 (22.6); first segmented dorsal-fin ray length 7.8–10.0 (damaged in holotype); third-from-last segmented dorsal-fin ray length 11.6–14.5 (13.8); dorsal-fin base length 62.2–66.4 (63.6); first segmented anal-fin ray length 7.6–9.8 (8.4); third-from-last segmented anal-fin ray length 12.0–14.3 (13.8); anal-fin base length 36.9–41.2 (38.9); caudal-fin length 18.3–20.9 (20.1); pectoral-fin length 18.7–21.1 (20.1); pelvic-fin length 14.3–17.2 (17.2).

Lower lip complete with deep symphyseal notch; fin spines weak and flexible; anterior dorsal-fin pterygiophore formula S/S/(S^v) + 2/1 + 1 (S/S/S^v + 2/1 + 1); 21–23 (23) consecutive dorsal-fin pterygiophores inserting in 1:1 relationship directly behind neural spine 4; anterior anal-fin pterygiophore formula 2/1 + 1 or 2 + 1/1 (2/1 + 1); 13–15 (13) consecutive anal-fin pterygiophores inserting in 1:1 relationship directly behind haemal spine 2; fourth segmented pelvic-fin ray longest; caudal fin rounded; ctenoid scales beginning at 3–7 (4/3) transverse scale rows behind branchial opening; dorsal and anal fins without distinct scale sheaths, though often with intermittent scales overlapping fin bases; intermittent series of centrally pitted scales originating on midside above anterior part of anal fin, extending posteriorly along caudal peduncle to middle part of caudal-fin base; additional 1–3 centrally pitted scales present above and below pitted scale(s) on middle part of caudal-fin base; cheeks, operculum and upper part of head without scales; predorsal scales extending anteriorly to point ranging from about 2/3 distance from dorsal origin to parietal commissure, to just short of parietal commissure (Fig. 1); vertebrae 10 + 23–24 (10 + 24); epurals 2; epineurals present on vertebrae 1 through 21–24 (23); pleural ribs present on vertebrae 3 through 10, the ultimate rib small to moderately developed.

Upper jaw with 3 or 4 (at symphysis) to 1 or 2 (on sides of jaw) irregular rows of small conical teeth, those of outer row much larger; lower jaw with 2 or 3 (at symphysis) to 1 (on sides of jaw) rows of small conical teeth, those of outer row much larger; vomer with 1 or 2 rows of small conical teeth arranged in chevron; palatines edentate; tongue edentate and moderately pointed.

Live coloration

Males not recorded in detail, but noted to be very similar to that of *A. kenyae*. Females not recorded in detail, but noted to be very similar to that of *A. kenyae*. Probable intermediate phase specimens(based on photograph and field notes taken on paratype from Mauritius, USNM 364534, 19.6 mm SL, when freshly dead, and on field notes taken on paratype from Réunion, SMNS 20933,

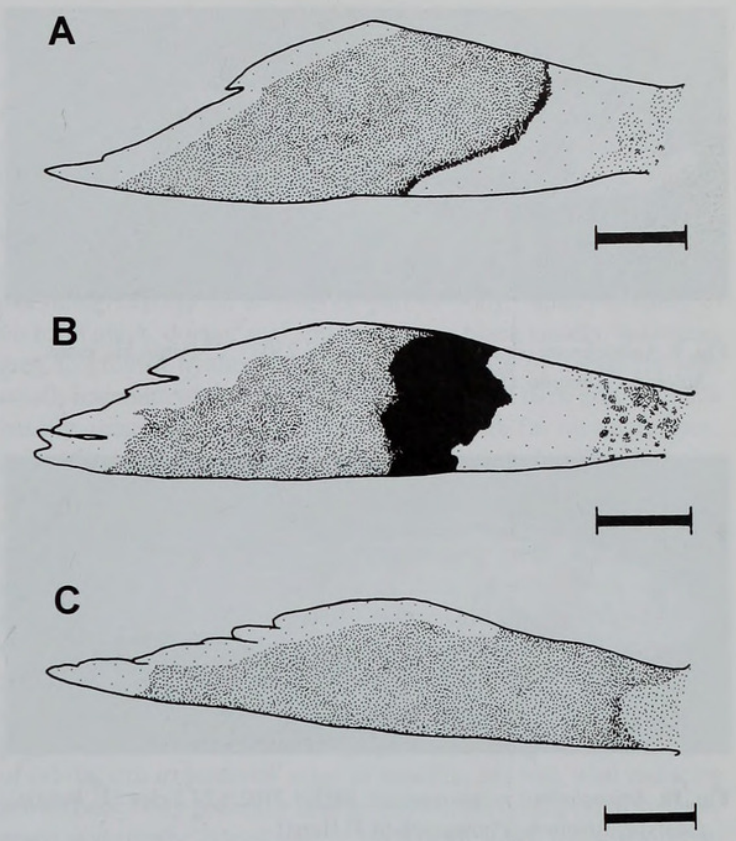

Fig. 8. Ventral view of right pelvic fin of A) *Anisochromis kenyae*, ROM 56501, 22.1 mm SL, male; B) *A. mascarenensis*, SMNS 21025, 25.2 mm SL, male paratype; C) *A. straussi*, USNM 216463, 25.2 mm SL, male paratype. Scale bars = 0.5 mm.

25.3 mm SL, when freshly dead): head reddish brown to bright red, with black-edged pale pink to white stripe extending from posterodorsal rim of orbit, above upper part of preopercle, to upper edge of operculum; prominent white streak at posteroventral corner of operculum, edged narrowly with black, with prominent black spot on mid-anterior edge; large white spot on middle of operculum, with scattered smaller white spots on upper edge of preopercle and on dorsoposterior part of head; white spots narrowly edged with black; two small, white spots on posteroventral rim of orbit, at about 3 and 5 o'clock positions; narrow dark grey to black bar extending from ventral part of orbital rim to posterior edge of maxilla; iris pale pink, with radiating dark brown bars; reddish brown coloration extending on to upper part of body immediately beneath lateral line, grading to dark bluish grey or black elsewhere on body; lateral-line scales pale pink; dorsal and anal fins dusky red basally, greyish hyaline distally, with white-edged black spot at base of each fin ray, anterior part of dorsal fin with large black spot, edged ventrally with orange; caudal fin dark grey basally, reddish grey on remainder of fin; fleshy pectoral-fin base and base of fin dark grey to black, with scattered white spots; remainder of pectoral fin hyaline; pelvic fin pale pinkish grey basally, grey to dark grey on remainder of fin, with pale grey to hyaline distal margin.

Preserved coloration

Males (Fig. 8B, 9) head pale brown, with pale stripe edged with dark grey-brown extending from posterodorsal rim of orbit, above upper part of preopercle, to upper edge of operculum; narrow brown to dark grey-brown bar extending from ventral part of orbital rim to posterior edge of maxilla; nape pale brown with dark grey-brown bar across parietal commissure; body dark grey-brown to black, with scattered indistinct pale brown spots; dorsal fin with large dark

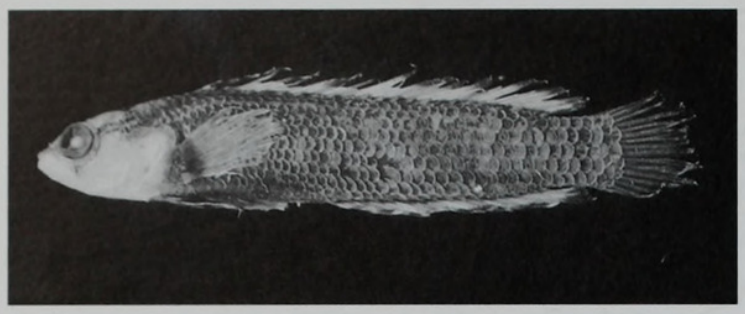

Fig. 9. *Anisochromis mascarenensis*, SMNS 23037, 23.9 mm SL, male, holotype, Réunion. (Photograph by P. Hurst)

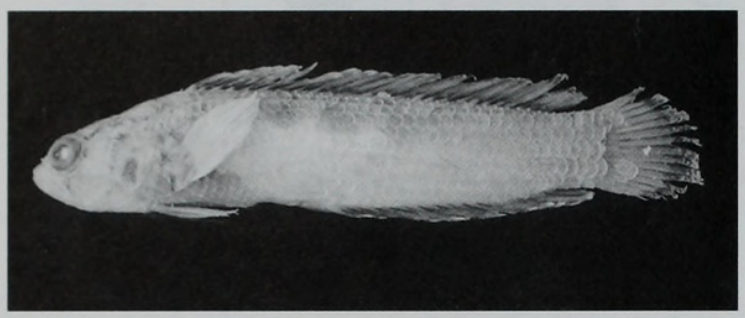

Fig. 10. *Anisochromis mascarenensis*, SMNS 21025, 24.2 mm SL, female, paratype, Réunion. (Photograph by P. Hurst)

grey to black spot, extending from first segmented ray to about fourth or fifth segmented ray; anal fin and remainder of dorsal fin pale brown to white; basal one-quarter of dorsal and anal fins dark greyish brown, with small white spot at base of each ray; distal one-quarter of dorsal and anal fins greyish hyaline to grey; caudal fin dark grey brown to black basally, remainder of fin greyish hyaline; pectoral fin dark greyish brown to black with irregular pale brown spots basally, remainder of fin greyish hyaline, with fin rays dark grey; pelvic fin with broad pale brown band near base of fin, edged basally with narrow slightly darker band or dappled spots and distally with dark grey (which is darkest immediately adjacent to pale band), distal edge of fin pale grey-brown. Females (Fig. 10): head brown dorsally, paler ventrally, with two or three dark brown bars on nape; large dark brown to dark grey-brown spot on subopercle, bordered irregularly with pale brown, sometimes with additional, smaller pale-edged dark brown spot on lower part of subopercle; brown-edged diffuse pale brown stripe extending from posterodorsal rim of orbit, above upper part of preopercle, to upper edge of operculum; cheek and operculum sometimes with irregular brown vermiform markings and spots; narrow dark brown to grey-brown bar extending from ventral part of orbital rim to posterior edge of maxilla; body pale brown; upper part of body with brown to grey-brown bars, becoming less distinct ventrally; broad pale yellow to pale brown area sometimes present on side of body; upper and lower edges of caudal peduncle sometimes with small, punctate black spots; dorsal and anal fins dusky brown to brownish hyaline, often with irregular pale brown small spots; barring on body sometimes extending slightly on to fin bases; caudal fin brown to grey brown, remainder of fin dusky brown to brownish hyaline; fleshy pectoral-fin base brown, with scattered pale spots; pectoral fin brownish hyaline to hyaline; pelvic fin dusky brown, pale brown distally. Probable intermediate phase specimens (Fig. 11): pattern generally similar to live coloration, reddish brown and red areas on head, body and fins become pale brown; white spots and markings on head, body and fins less distinct, becoming pale grey to pale yellowish

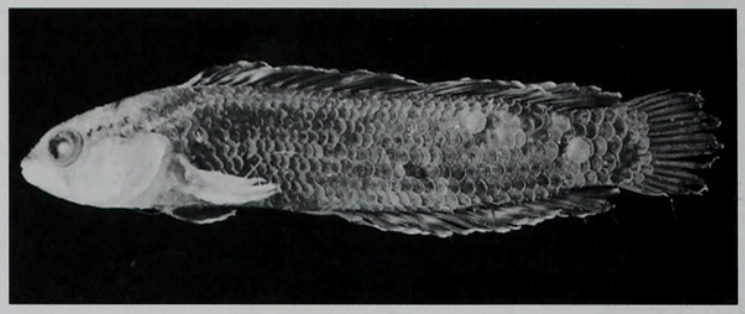

Fig. 11. *Anisochromis mascarenensis*, SMNS 20933, 25.5 mm SL, sexually transforming individual(?), paratype, Réunion. (Photograph by P. Hurst)

brown; dark spots and markings on head, body and fins become dark brown to dark grey-brown; indistinct dark spot or ocellated dark spot (as in females) variably present on subopercle; body either more-or-less uniformly dark grey-brown (except for pale spots) or dark grey-brown with narrow pale brown bands; pelvic fins mostly dusky brown to dark grey-brown, with broad pale band near fin base and pale brown to hyaline distal margin.

HABITAT AND DISTRIBUTION

Anisochromis mascarenensis is known only from Réunion and Mauritius, Mascarene Islands (Fig. 6). It has been collected from lagoon reefs with live and dead corals in 0–18 m. Most specimens collected by the second author at Réunion emerged from the base of live, branched *Acropora*.

COMPARISONS WITH OTHER SPECIES

See under *A. kenyae*.

REMARKS

Anisochromis mascarenensis is apparently not common in Mauritius. The first author and associates made 13 rotenone stations in apparently appropriate habitat (around shallow lagoonal reefs) in Mauritius, but collected only a single specimen.

ETYMOLOGY

The specific epithet alludes to the distribution of the species.

MATERIAL EXAMINED

See above under type material.

Anisochromis straussi Springer, Smith & Fraser, 1977

Saint Brandon's Annie

Figs 6, 7, 8C, 12–13; Tables 1–11

Anisochromis straussi Springer, Smith & Fraser, 1977: 2, figs 1a, 1b and 2 [type locality: 2 miles east of Raphael Island, Saint Brandon's Shoals; holotype USNM 21642].– Godkin & Winterbottom, 1985: 634, fig. 1D [osteological and myological comparison]– Mooi, 1990: 457, tables 1,3, fig. 2e [egg surface morphology].

DIAGNOSIS

The following characters distinguish *A. straussi* from congeners: dorsal-fin rays I,25–27, usually I,26; anal-fin rays I,17–19, usually I,18; caudal vertebrae 23–25, usually 24; scales in lateral series 41–45, usually 41–44; anterior lateral-line scales 32–39, usually 33–37; posterior interorbital pores 1–2; total parietal pores 14–30; and dorsal fin of male specimens generally dusky in preservative, without large dark spot on anterior part of fin.

DESCRIPTION (Based on 82 specimens, 16.1–28.3 mm SL)

Dorsal-fin rays I,25–27 (I,26), all segmented rays branched; anal-fin rays I,17–19 (I,18), all segmented rays branched; pectoral-fin rays

13–15 (14/14), upper 1–2 (1/1) and lower 0–1 (0/0) rays simple; pelvic-fin rays I,4, medial ray small, inconspicuous and unbranched, all other segmented rays branched; upper procurrent caudal-fin rays 4–6 (5); lower procurrent caudal-fin rays 3–4 (4); principal caudal-fin rays 8 + 8, upper 0–1 (0) and lower 0–1 (0) unbranched; total caudal-fin rays 23–26 (25); scales in lateral series 41–45 (43/43); anterior lateral-line scales 32–39 (32/34); anterior lateral line terminating beneath segmented dorsal-fin ray 18–24 (18/19); predorsal scales 4–7 (6); scales in transverse series 11–14 + 1 + 2–3 = 14–18 (12 + 1 + 3/13 + 1 + 2); circumpeduncular scales 12–14 (12); gill rakers 2 + 2–3, sometimes with 1–2 tiny rudiments (inconspicuous ossifications bearing a few or no teeth) above and below rakers (gill raker count not determined in holotype); pseudobranch filaments 6–7 (not determined in holotype).

Cephalic laterosensory pores (all bilaterally paired, unless otherwise stated): nasal pores 2–3 (2/2); anterior interorbital pores 1–3 (2/2); posterior interorbital pores (unpaired) 1–2 (2); supraotic pores 1–3 (3/2); suborbital pores 8–13 (12/11); posterior otic pores 2–7 (3/2); preopercular pores 9–15 (13/13); dentary pores 3–4 (4/4); intertemporal pores 1–2 (1/1); anterior temporal pores 0–1 (1/1); posttemporal pores 1; total parietal pores 14–30 (25).

As percentage of standard length (based on 20 specimens, 16.7–27.0 mm SL): body depth at dorsal-fin origin 19.2–21.8 (21.8); greatest body depth 20.6–23.8 (23.8); head width 11.5–13.7 (12.1); head length 24.6–28.6 (27.2); snout length 4.2–5.7 (5.4); orbit diameter 6.5–9.0 (7.1); interorbital width 3.3–4.5 (3.8); upper jaw length 9.1–10.5 (10.5); caudal peduncle depth 12.7–15.6 (14.2); caudal peduncle length 8.2–10.7 (9.6); predorsal length 27.7–31.7 (30.5); preanal length 48.9–52.9 (49.8); prepelvic length 22.6–25.7 (23.4); first segmented dorsal-fin ray length 7.9–10.1 (7.9); third-from-last segmented dorsal-fin ray length 11.7–14.9 (14.2); dorsal-fin base length 62.0–66.9 (66.9); first segmented anal-fin ray length 6.9–8.9 (7.1); third-from-last segmented anal-fin ray length 12.3–14.4 (13.8); anal-fin base length 38.1–41.8 (41.0); caudal-fin length 17.8–20.7 (20.5); pectoral-fin length 15.9–20.8 (19.2); pelvic-fin length 10.5–17.8 (15.1).

Lower lip complete with deep symphyseal notch; fin spines weak and flexible; anterior dorsal-fin pterygiophore formula S/S/(S^v) + 2/1 + 1 (S/S/2/1 + 1); 21–24 (23) consecutive dorsal-fin pterygiophores inserting in 1:1 relationship directly behind neural spine 4; anterior anal-fin pterygiophore formula 2/1 + 1, 2 + 1/1 or 2 + 1 + 1/1 (2/1 + 1); 12–16 (13) consecutive anal-fin pterygiophores inserting in 1:1 relationship directly behind haemal spine 2; fourth segmented pelvic-fin ray longest; caudal fin rounded; ctenoid scales beginning at 3–14 (4/3) transverse scale rows behind branchial opening; dorsal and anal fins without distinct scale sheaths, though often with intermittent scales overlapping fin bases; intermittent series of centrally pitted scales originating on midside above anterior part of anal fin, extending posteriorly along caudal peduncle to middle part of caudal-fin base; additional 1–3 centrally pitted scales present above and below pitted scale(s) on middle part of caudal-fin base; cheeks, operculum and upper part of head without scales; predorsal scales extending anteriorly to point ranging from about 2/3 distance from dorsal origin to parietal commissure, to just short of parietal commissure; vertebrae 10–11 + 23–25 = 33–35 (10 + 24); epurals 2; epineurals present on vertebrae 1 through 20–27 (22); pleural ribs present on vertebrae 3 through 10, the ultimate rib very small to moderately developed.

Upper jaw with 3 or 4 (at symphysis) to 1 or 2 (on sides of jaw) irregular rows of small conical teeth, those of outer row much larger; lower jaw with 2 or 3 (at symphysis) to 1 (on sides of jaw) rows of small conical teeth, those of outer row much larger; vomer with 1 or 2 rows of small conical teeth arranged in chevron; palatines edentate; tongue edentate and moderately pointed.

Live coloration

Males (based on a photograph of a probable paratype, and on the description given by Springer *et al.*, 1977: 4) head bright reddish orange, with black-edged white stripe extending from posterodorsal rim of orbit, above upper part of preopercle, to upper edge of operculum; two white spots on posteroventral rim of orbit, at about 3 and 5 o'clock positions; narrow dark grey bar extending from ventral part of orbital rim to posterior edge of maxilla; iris yellow, red centrally, with radiating brown bars; reddish orange coloration extending slightly on to anterior part of body, rapidly grading to uniform black; dorsal, anal and caudal fins black basally, becoming grey to greyish hyaline on distal margin; base of dorsal fin with small, intermittent pale grey spots; pectoral fin dark grey to black basally, remainder of fin greyish hyaline, with fin rays dark grey; pelvic fin black, with distal margin pale grey to hyaline. Females (based on photographs of two probable paratypes, and on the description given by Springer *et al.*, 1977: 4) head olive-brown to brown dorsally, becoming pale green to lime green ventrally, with two pale olive bars on nape; large dark grey to black spot on subopercle, bordered irregularly with white; black-edged white stripe extending from posterodorsal rim of orbit, above upper part of preopercle, to upper edge of operculum; two white spots or clusters of white spots on posteroventral rim of orbit, at about 3 and 5 o'clock positions; narrow dark brown to grey bar extending from ventral part of orbital rim to posterior edge of maxilla; iris red, with radiating brown bars; body generally orange-brown, becoming olive to dusky green posteriorly; dorsal part of body with short, indistinct olive-brown bars, alternating with pale olive to orange-brown bars; pale olive to orange-brown bars sometimes extending on to lower part of body, becoming pale pink ventrally; broad orange-yellow area often present on side of body; dorsal and anal fins dusky green to dusky orange; barring on upper part of body extending slightly on to dorsal-fin base; dark bars on posterior part of dorsal-fin base sometimes bearing dark grey to black punctate spots; distal margins of dorsal and anal fins abruptly pale grey to hyaline; caudal fin olive to lime green basally, remainder of fin dusky olive to dusky orange; fleshy pectoral-fin base dusky orange to dusky olive, with scattered small white spots; pectoral fin lime green basally, becoming greenish to orangish hyaline distally; pelvic fin olive to grey basally, remainder of fin dark olive to dark grey, with pale grey to hyaline distal margin.

Preserved coloration

Males (Fig. 8C, 12): pattern generally similar to live coloration, head and anterior part of body becoming pale brown, paler ventrally; pale markings on head obsolete; dark spots and stripes on head remain, though sometimes faint, becoming brown to dark grey-brown; body behind pectoral-fin base dark grey-brown; several indistinct pale brown spots sometimes present on anterodorsal part

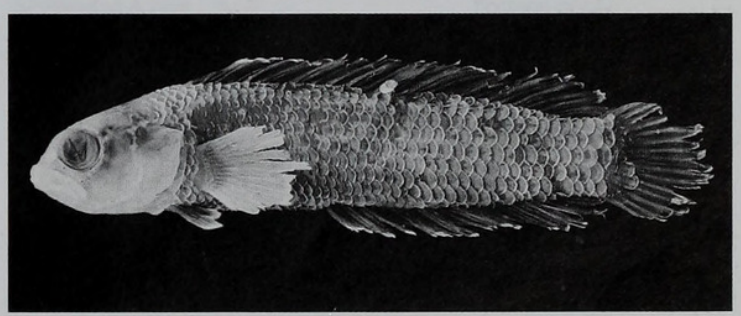

Fig. 12. *Anisochromis straussi*, USNM 216463, 24.7 mm SL, male, paratype, Saint Brandon's Shoals. (Photograph by P. Hurst)

Fig. 13. *Anisochromis straussi*, USNM 216463, 22.8 mm SL, female, paratype, Saint Brandon's Shoals. (Photograph by P. Hurst)

of body; coloration of fins similar to when live; pale brown spots often present at base of each dorsal-fin ray; several pale brown spots sometimes present basally on anterior part of dorsal fin. Females (Fig. 13): pattern generally similar to live coloration, head and body becoming pale brown; pale markings on head and body indistinct or absent; dark spots and stripes on head mostly remain, becoming dark grey-brown to dark brown (ocellated spots sometimes absent, though possibly these represent intermediately coloured, sex-transforming specimens), sometimes with additional irregular brown spots and markings on cheek and operculum; dark barring on head and body variably remains, becoming brown to pale brown; dark punctate spots on caudal peduncle remain, becoming dark brown to dark grey-brown, sometimes extending anteriorly to near middle of dorsal- and anal-fin bases, ocassionally extending on to sides of body; dorsal and anal fins dusky brown to brownish hyaline, often with irregular pale brown small spots; barring on body sometimes extending slightly on to fin bases; caudal fin pale brown, remainder of fin pale brown to hyaline; pectoral-fin base pale brown, remainder of fin pale brown to hyaline; pelvic fin dusky brown to brownish hyaline, paler on base and distal margin.

Habitat and Distribution

Anisochromis straussi is known only from Saint Brandon's Shoals (Fig. 6). According to Springer *et al.* (1977: 6), it was collected in 0.25–11 m from rocky reefs that included dead and live coral, proximate to areas exposed at low tide. They further noted that 'specimens of *A. straussi* were lying on the bottom adjacent to isolated, small (perhaps less than 0.5 meter in diameter), live coral heads with surfaces composed of tiny finger-like projections. Our presumption is that the *Anisochromis* were living in the corals.'

Comparisons with other species

See under *A. kenyae*.

Remarks

Springer *et al.* (1977) gave a standard length of 25.5 mm for the holotype of *A. straussi*, whereas we measured it as only 23.9 mm.

Material Examined

Saint Brandon's Shoals (= Cargados Carajos) Lagoon at Tortue Island (16°19'S 059°41'E), 0.15 m (stated depth 0.5 feet), V.G. Springer *et al.*, 7 April 1976 (field number VGS 76-11), USNM 216463, 19: 16.2–27.0 mm SL (paratypes); 2 miles east of Raphael Island (16°20'S 059°38.5'E), inside edge of reef flat, 0.15–1.05 m (stated depth 0.5–3.5 feet), V.G. Springer *et al.*, 3 April 1976 (field number VGS 76-7), USNM 216462, 1: 23.9 mm SL (holotype), USNM 215859, 26: 18.7–26.1 mm SL (paratypes; x-radiographs only); off northern tip of Saint Brandon's Shoals, ca. 16°25'S 59°36'E, rocky reef with some live coral and some channels and white coarse sand bottom, 6–10.5 m (stated depth 20–35 feet), V.G. Springer *et al.*, 6 April 1976 (field number VGS 76-10), BMNH 1976.8.24.1–10, 10: 16.8–25.4 mm SL (paratypes; 21.5 mm SL paratype subsequently cleared and stained); about 100 yards off west side of Raphael Island (ca. 16°26'S 059°36'E), coral patch in surge channel, 0–7.5 m (stated depth 0–25 feet), V.G. Springer *et al.*, 2 April 1976 (field number VGS 76-6), USNM 216464, 1: 26.8 mm SL (paratype; x-radiograph only); lagoon south of Raphael Island (ca. 16°28'S 059°37'E), live and dead coral reef surrounded by fine white sand, 0–3.6 m (stated depth 0–12 feet), V.G. Springer *et al.*, 8 April 1976 (field number VGS 76-12), USNM 216466, 2: 26.5–28.3 mm SL (paratypes; x-radiographs only); along southeast side of Grande Passe (ca. 16°28'S 059°40'E), face and channels of reef, 0–6 m (stated depth 0–20 feet), V.G. Springer *et al.*, 5 April 1976 (field number VGS 76-9), CAS 37640, 14: 16.1-24.9 mm SL (paratypes; x-radiographs only); ca. 16°32'S 059°41'E, 0–2 m, V.G. Springer *et al.*, 30 March 1976 (field number VGS 76-1), USNM 216465, 3: 22.6–23.9 mm SL (paratypes; x-radiographs only); ca. 16°43'S 059°35'E, live coral reef with dead rock and coral, rubble shore, 0–1.2 m (stated depth 0–4 feet), V.G. Springer *et al.*, 11 April 1976 (field number VGS 76-17), AMNH 35892, 6: 22.0–28.0 mm SL (paratypes; x-radiographs only).

KEY TO SPECIES OF *ANISOCHROMIS*

1a. Dorsal-fin rays I,25–26, usually I,25; anal-fin rays I,17–18, usually I,17; caudal vertebrae 22–24, usually 23; scales in lateral series 37–44, usually 38–41; anterior lateral-line scales 28–35, usually 30–34 (east Africa, Comoros Islands and Madagascar) ..... *kenyae* Smith

1b Dorsal-fin rays I,25–27, usually I,26; anal-fin rays I,17–19, usually I,18; caudal vertebrae 23–25, usually 24; scales in lateral series 40–45, usually 41–44; anterior lateral-line scales 32–39, usually 33–37 2

2a Dorsal fin of male specimens pale in preservative, with conspicuous, large dark spot distally on anterior part of fin; pelvic fins of preserved males broadly pale on basal part of fin (sometimes slightly darker or dappled with darker spots on basalmost portion of fin) and abruptly dark distally, sometimes with pale distal margin; posterior interorbital pores 3–4; total parietal pores 23–44, usually more than 30 (Réunion and Mauritius) ..... *mascarenensis* sp.nov.

2b Dorsal fin of male specimens generally dusky in preservative, without large dark spot on anterior part of fin; pelvic fins of males mostly dusky in preservative, although sometimes with narrow pale basal area, with pale distal margin; posterior interorbital pores 1–2; total parietal pores 14–30 (Saint Brandon's Shoals) ..... *straussi* Springer, Smith & Fraser

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Table 1 Frequency distributions of dorsal-, anal- and pectoral-fin-ray counts for *Anisochromis* species. Bilateral counts of pectoral-fin rays are included.

	Segmented D rays					Segmented A rays					Pectoral rays				
	25	*26*	*27*	$\bar{x}$	*SD*	*17*	*18*	*19*	$\bar{x}$	*SD*	*13*	*14*	*15*	$\bar{x}$	*SD*
A. kenyae															
Kenya	22	2	–	25.1	0.3	23	1	–	17.0	0.2	1	15	4	14.2	0.5
Tanzania	1	–	–			1	–	–			No data taken				
Mozambique	7	–	–	25.0	0.0	7	–	–	17.0	0.0	1	9	–	13.9	0.3
Comoros	9	3	–	25.3	0.5	10	2	–	17.2	0.4	4	20	–	13.8	0.4
Madagascar	–	1	–			1	1	–	17.5	0.7	–	4	–	14.0	0.0
Total	39	6	–	25.1	0.3	42	4	–	17.1	0.3	6	48	4	14.0	0.4
A. mascarenensis															
Réunion	1	9	–	25.9	0.3	2	8	–	17.8	0.4	7	13	–	13.7	0.5
Mauritius	–	1	–			–	1	–			2	–	–	13.0	0.0
Total	1	10	–	25.9	0.3	2	9	–	17.8	0.4	9	13	–	13.6	0.5
A. straussi	10	69	2	25.9	0.4	5	74	2	18.0	0.3	8	51	1	13.9	0.4

Table 2 Frequency distributions of caudal-fin-ray counts for *Anisochromis* species.

	Procurrent caudal-fin rays									
	Upper					Lower				
	4	*5*	*6*	$\bar{x}$	*SD*	*3*	*4*	*5*	$\bar{x}$	*SD*
A. kenyae										
Kenya	1	20	2	5.0	0.4	–	17	6	4.3	0.4
Tanzania	–	1	–			–	1	–		
Mozambique	–	5	1	5.2	0.4	–	6	1	4.1	0.4
Comoros	–	10	2	5.2	0.4	–	8	4	4.3	0.5
Madagascar	–	2	–	5.0	0.0	–	2	–	4.0	0.0
Total	1	38	5	5.1	0.4	–	34	11	4.2	0.4
A. mascarenensis										
Réunion	–	10	–	5.0	0.0	–	8	2	4.2	0.4
Mauritius	–	1	–			–	1	–		
Total	–	11	–	5.0	0.0	–	9	2	4.2	0.4
A. straussi	3	74	2	5.0	0.3	1	78	–	4.0	0.1

	Total caudal-fin rays						
	23	*24*	*25*	*26*	*27*	$\bar{x}$	*SD*
A. kenyae							
Kenya	–	1	15	6	1	25.3	0.6
Tanzania	–	–	1	–	–		
Mozambique	–	–	4	2	–	25.3	0.5
Comoros	–	–	8	2	2	25.5	0.8
Madagascar	–	–	2	–	–	25.0	0.0
Total	–	1	30	10	3	25.3	0.6
A. mascarenensis							
Réunion	–	–	8	2	–	25.2	0.4
Mauritius	–	–	1	–	–		
Total	–	–	9	2	–	25.2	0.4
A. straussi	1	2	72	2	–	25.0	0.3

Table 3 Frequency distributions of vertebral counts for *Anisochromis* species.

	Precaudal				Caudal					
	10	*11*	$\bar{x}$	*SD*	*22*	*23*	*24*	*25*	$\bar{x}$	*SD*
A. kenyae										
Kenya	24	–	10.0	0.0	2	21	1	–	23.0	0.4
Tanzania	1	–			–	1	–	–		
Mozambique	7	–	10.0	0.0	1	6	–	–	22.9	0.4
Comoros	12	–	10.0	0.0	1	11	–	–	22.9	0.3
Madagascar	2	–	10.0	0.0	–	1	1	–	23.5	0.7
Total	46	–	10.0	0.0	4	40	2	–	23.0	0.4
A. mascarenensis										
Réunion	10	–	10.0	0.0	–	2	8	–	23.8	0.4
Mauritius	1	–			–	–	1	–		
Total	11	–	10.0	0.0	–	2	9	–	23.8	0.4
A. straussi	79	2	10.0	0.2	–	12	68	1	23.9	0.4

	Total					
	32	*33*	*34*	*35*	$\bar{x}$	*SD*
A. kenyae						
Kenya	2	21	1	–	33.0	0.4
Tanzania	–	1	–	–		
Mozambique	1	6	–	–	32.9	0.4
Comoros	1	11	–	–	32.9	0.3
Madagascar	–	1	1	–	33.5	0.7
Total	4	40	2	–	33.0	0.4
A. mascarenensis						
Réunion	–	2	8	–	33.8	0.4
Mauritius	–	–	1	–		
Total	–	2	9	–	33.8	0.4
A. straussi	–	10	70	1	33.9	0.4

Table 4 Frequency distributions of numbers of consecutive dorsal-fin pterygiophores inserting in 1:1 relationship with interneural spaces directly behind neural spine 4, and anal-fin pterygiophores inserting in 1:1 relationship with interhaemal spaces directly behind haemal spine 2 for species of *Anisochromis*.

	1:1 D pterygiophores							1:1 A pterygiophores						
	20	*21*	*22*	*23*	*24*	$\bar{x}$	*SD*	*12*	*13*	*14*	*15*	*16*	$\bar{x}$	*SD*
A. kenyae														
Kenya	1	1	21	1	–	21.9	0.5	1	–	22	1	–	14.0	0.5
Tanzania	–	–	1	–	–			–	–	1	–	–		
Mozambique	–	–	7	–	–	22.0	0.0	1	–	6	–	–	13.7	0.8
Comoros	1	2	7	–	–	21.6	0.7	3	2	4	–	–	13.1	0.9
Madagascar	–	–	1	–	–			–	–	1	1	–	14.5	0.7
Total	2	3	37	1	–	21.9	0.5	5	2	34	2	–	13.8	0.7
A. mascarenensis														
Réunion	–	2	2	5	–	22.3	0.9	–	3	2	4	–	14.1	0.9
Mauritius	–	–	1	–	–			–	–	–	1	–		
Total	–	2	3	5	–	22.3	0.8	–	3	2	5	–	14.2	0.9
A. straussi	–	14	8	57	2	22.6	0.8	1	23	6	48	1	14.3	1.0

Table 5 Frequency distributions of counts of scales in lateral series for *Anisochromis* species. Bilateral counts are included.

	37	*38*	*39*	*40*	*41*	*42*	*43*	*44*	*45*	$\bar{x}$	*SD*
A. kenyae											
Kenya	–	2	5	5	4	2	1	1	–	40.3	1.6
Mozambique	–	–	3	3	3	1	–	–	–	40.2	1.0
Comoros	1	4	7	8	4	–	–	–	–	39.4	1.1
Madagascar	–	–	2	1	1	–	–	–	–	39.8	1.0
Total	1	6	17	17	12	3	1	1	–	39.9	1.3
A. mascarenensis											
Réunion	–	–	–	1	–	5	4	5	2	43.1	1.3
Mauritius	–	–	–	–	–	1	–	1	–	43.0	1.4
Total	–	–	–	1	–	6	4	6	2	43.1	1.3
A. straussi	–	–	–	–	6	19	20	13	1	42.7	1.0

Table 6 Frequency distributions of counts of anterior lateral-line scales for *Anisochromis* species. Bilateral counts are included.

	28	*29*	*30*	*31*	*32*	*33*	*34*	*35*	*36*	*37*	*38*	*39*	$\bar{x}$	*SD*
A. kenyae														
Kenya	1	1	3	4	1	–	3	1	–	–	–	–	31.4	2.1
Mozambique	–	–	1	2	1	4	1	–	–	–	–	–	32.2	1.3
Comoros	3	2	4	5	4	3	–	–	–	–	–	–	30.7	1.6
Madagascar	–	–	1	2	1	–	–	–	–	–	–	–	31.0	0.8
Total	4	3	9	13	7	7	4	1	–	–	–	–	31.2	1.7
A. mascarenensis														
Réunion	–	–	–	–	1	2	2	7	3	1	1	1	35.2	1.7
Mauritius	–	–	–	–	–	–	–	1	1	–	–	–	35.5	0.7
Total	–	–	–	–	1	2	2	8	4	1	1	1	35.2	1.6
A. straussi	–	–	–	–	2	7	13	12	10	6	3	1	35.0	1.6

Table 7 Frequency distributions of anterior lateral-line termination positions (relative to segmented dorsal-fin rays) for *Anisochromis* species. Bilateral counts are included.

	Segmented dorsal-fin ray									
	17	*18*	*19*	*20*	*21*	*22*	*23*	*24*	$\bar{x}$	*SD*
A. kenyae										
Kenya	1	4	4	3	2	–	–	–	19.1	1.2
Mozambique	–	1	3	3	2	–	–	–	19.7	1.0
Comoros	2	3	9	3	4	–	–	–	19.2	1.2
Madagascar	–	–	–	2	–	–	–	–	20.0	0.0
Total	3	8	16	11	8	–	–	–	19.3	1.1
A. mascarenensis										
Réunion	–	–	1	5	6	4	2	–	21.1	1.1
Mauritius	–	–	–	–	1	1	–	–	21.5	0.7
Total	–	–	1	5	7	5	2	–	21.1	1.1
A. straussi	–	1	3	9	19	12	9	1	21.3	1.3

Table 8 Frequency distributions of counts of scales in transverse series for *Anisochromis* species. Bilateral counts are included.

	Scales below lateral line							Scales above lateral line			
	10	*11*	*12*	*13*	*14*	$\bar{x}$	*SD*	*2*	*3*	$\bar{x}$	SD
A. kenyae											
Kenya	7	7	4	1	–	10.9	0.9	19	1	2.1	0.2
Mozambique	4	6	–	–	–	10.6	0.5	9	1	2.1	0.3
Comoros	5	13	6	–	–	11.0	0.7	24	–	2.0	0.0
Madagascar	2	1	1	–	–	10.8	1.0	4	–	2.0	0.0
Total	18	27	11	1	–	10.9	0.8	56	2	2.0	0.2
A. mascarenensis											
Réunion	–	11	7	–	–	11.4	0.5	17	1	2.1	0.2
Mauritius	1	1	–	–	–	10.5	0.7	2	–	2.0	0.0
Total	1	12	7	–	–	11.3	0.6	19	1	2.1	0.2
A. straussi	–	15	33	9	1	11.9	0.7	36	22	2.4	0.5

	Total scales in transverse series							
	13	*14*	*15*	*16*	*17*	*18*	$\bar{x}$	*SD*
A. kenyae								
Kenya	7	7	4	–	1	–	14.0	1.1
Mozambique	4	5	1	–	–	–	13.7	0.7
Comoros	5	13	6	–	–	–	14.0	0.7
Madagascar	2	1	1	–	–	–	13.8	1.0
Total	18	26	12	–	1	–	13.9	0.8
A. mascarenensis								
Réunion	–	11	6	1	–	–	14.4	0.6
Mauritius	1	1	–	–	–	–	13.5	0.7
Total	1	12	6	1	–	–	14.4	0.7
A. straussi	–	12	22	19	4	1	15.3	0.9

Table 9 Frequency distributions of counts of predorsal and circumpeduncular scales for *Anisochromis* species.

	Predorsal scales							Circumpeduncular scales				
	4	*5*	*6*	*7*	*8*	$\bar{x}$	*SD*	*12*	*13*	*14*	$\bar{x}$	*SD*
A. kenyae												
Kenya	–	1	5	3	1	6.4	0.8	9	1	–	12.1	0.3
Mozambique	1	1	1	1	–	5.5	1.3	3	2	–	12.4	0.5
Comoros	2	6	4	–	–	5.2	0.7	12	–	–	12.0	0.0
Madagascar	–	2	–	–	–	5.0	0.0	2	–	–	12.0	0.0
Total	3	10	10	4	1	5.6	1.0	26	3	–	12.1	0.3
A. mascarenensis												
Réunion	–	5	4	–	–	5.4	0.5	9	–	–	12.0	0.0
Mauritius	–	1	–	–	–			1	–	–		
Total	–	6	4	–	–	5.4	0.5	10	–	–	12.0	0.0
A. straussi	5	13	11	1	–	5.3	0.8	21	8	1	12.3	0.5

Table 10 Frequency distributions of position of first ctenoid scale (relative to anterior lateral line scales) for *Anisochromis* species.

	1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14*	$\bar{x}$	*SD*
A. kenyae																
Kenya	–	1	7	5	–	–	–	–	–	–	–	–	–	–	3.3	0.6
Mozambique	2	1	3	2	–	–	–	–	–	–	–	–	–	–	2.6	1.2
Comoros	–	–	9	7	4	–	2	–	–	–	–	–	–	–	4.0	1.2
Madagascar	1	–	1	–	2	–	–	–	–	–	–	–	–	–	3.5	1.9
Total	3	2	20	14	6	–	2	–	–	–	–	–	–	–	3.6	1.2
A. mascarenensis																
Réunion	–	–	4	8	3	1	1	–	–	–	–	–	–	–	4.2	1.1
Mauritius	–	–	–	1	–	–	–	–	–	–	–	–	–	–		
Total	–	–	4	9	3	1	1	–	–	–	–	–	–	–	4.2	1.1
A. straussi	–	–	1	11	9	7	8	7	7	5	1	–	–	1	6.7	2.3

Table 11 Frequency distributions of counts of posterior interorbital pores for *Anisochromis* species.

	1	*2*	*3*	*4*	*5*	$\bar{x}$	*SD*
A. kenyae							
Kenya	–	3	5	2	–	2.9	0.7
Mozambique	–	4	–	1	–	2.4	0.9
Comoros	1	8	–	2	1	2.5	1.2
Madagascar	–	1	–	–	–		
Total	1	16	5	5	1	2.6	1.0
A. mascarenensis							
Réunion	–	–	7	2	–	3.2	0.4
Mauritius	–	–	1	–	–		
Total	–	–	8	2	–	3.2	0.4
A. straussi	4	25	–	–	–	1.9	0.4