

# ICHTHYOLOGICAL BULLETIN

of the

J. L. B. SMITH INSTITUTE OF ICHTHYOLOGY

RHODES UNIVERSITY, GRAHAMSTOWN

---

NUMBER 37

MARCH 1978

---

## ABSTRACT

A TAXONOMIC STUDY OF  
THE GENUS *LETHRINOPS* REGAN  
(PISCES: CICHLIDAE) FROM LAKE MALAWI

PART 2

by

DAVID H. ECCLES and DIGBY S.C. LEWIS

Ministry of Agriculture and Natural Resources Fisheries Department, Fisheries Research Station,  
P.O. Box 27, Monkey Bay, Malawi.

CONTENTS

A TAXONOMIC STUDY OF THE  
GENUS *LETHRINOPS* REGAN (PISCES: CICHLIDAE)  
FROM LAKE MALAWI – PART 2

by

DAVID H. ECCLES<sup>1</sup> AND DIGBY S.C. LEWIS<sup>2</sup>

ABSTRACT

*Lethrinops argentea* Ahl, *L. lethrinus* (Gunther) and *L. leptodon* Regan are re-described and illustrated. An additional new species, *L. longipinnis*, sharing with the above the possession a steeply sloping, wedge-shaped snout, a slender lower pharyngeal bone and few (9–14) gill-rakers is described. The status of *L. lunaris* Trewavas is discussed.

1 Senior Fisheries Research Officer, Fisheries Research Station, P.O. Box 27, Monkey Bay, Malaŵi.

2. Fisheries Research Officer, Fisheries Research Station, P.O. Box 27, Monkey Bay, Malaŵi.

INTRODUCTION

Part 1 of this paper (Part 1 and Lewis, 1973) has covered the diagnosis and relationships of the genera *Lethrinops* and *Lethrinus* to species which are characterized by the possession of a lower pharyngeal bone deeply pitted on the lateral face. The present paper describes another well defined group of species which is distinguished by the possession of a long straight straggling lower jaw, a long body and a range of 9–14 gill rakers.

The genus *Lethrinops* was first established by Trewavas (1965) in the form of *Lethrinops longipinnis* n. sp. and *Lethrinops argentea* Ahl. The following descriptions of these species have been credited from the present paper.

The methods of measurement and nomenclature of the terms used are as follows:

ABBREVIATIONS

- LMTS - Lake Malawi Fishing Survey
- BMNH - British Museum (Natural History)
- RUSI - I.L.R. School Institute of Ichthyology, Rhodes University, Grahamstown
- QVM - Queen Victoria Museum, Salisbury, Rhodesia
- USNM - United States National Museum
- MACT - Museum of Zoology, University of Toronto
- MFRU - Malawi Fisheries Research Unit



FIG. 1. *Lethrinops longipinnis* n. sp. (Lake Malawi, Malawi) (Museum of Zoology, University of Toronto).

*Lethrinops longipinnis* n. sp. (Fig. 1)

DIAGNOSIS

A moderate size species, attaining a maximum length of about 10 cm. Body in a group of species which is characterized by the possession of a long, straggling lower jaw, a slender long pharyngeal bone with well spaced teeth, and five to six gill rakers. Differs from *L. argentea* in having fewer teeth of teeth on flattened pharyngeal teeth and more elongate pharyngeal teeth.

MATERIAL EXAMINED

Malawi: Malawi, 21 specimens, 10 males, 11 females, and 1 juvenile. Type locality: Lake Malawi, Linyanti and Shire River confluence. Date of collection: 1972. Length: 10.5 cm. (Museum of Zoology, University of Toronto).

PARATYPES: 1 female, Malawi, Shire River, 10.5 cm, December, 1974. (Museum of Zoology, University of Toronto).

1975. (Museum of Zoology, University of Toronto).

CONTENTS

Introduction . . . . . 1

Abbreviations . . . . . 1

*Lethrinops longipinnis* n. sp. . . . . 1

*Lethrinops argentea* Ahl . . . . . 3

*Lethrinops lethrinus* (Gunther) . . . . . 6

*Lethrinops leptodon* Regan . . . . . 8

*Lethrinops lunaris* Trewavis . . . . . 10

Discussion . . . . . 11

## INTRODUCTION

Part 1 of this series (Eccles and Lewis, 1977) discussed the diagnosis and relationships of the genus *Lethrinops* and described three species which are characterised by the possession of a lower pharyngeal bone densely paved with fine flat tipped teeth. The present paper investigates another well defined group of species which is characterised by the possession of a long, straight, steeply sloping snout, a deep body and a range of 9–14 gill-rakers.

Within this group are *Lethrinops argentea* Ahl, *L. lethrinus* (Gunther), *L. leptodon* Regan, *L. lunaris* Trewavas and a fifth species new to science.

The type material of *L. argentea* has been re-examined and the description of this species completely revised. It has not been possible to remeasure all the type specimens of *L. lethrinus*, *L. leptodon*, and *L. lunaris* and some of the measurements given in the following descriptions of these species have been transcribed from Regan (1921) and Trewavas (1931).

The methods of measurement and explanations of the terms used are given in Part 1 of this series.

## ABBREVIATIONS

Abbreviations used for collections or institutions are as follows:

- LMTS – Lake Malawi Trawling Survey
- BMNH – British Museum (Natural History)
- RUSI – J.L.B. Smith Institute of Ichthyology, Rhodes University, Grahamstown
- QVM – Queen Victoria Museum, Salisbury, Rhodesia
- USNM – United States National Museum
- MACT – Mus ée de l’Afrique centrale, Tervuren
- MFRU – Malawi Fisheries Research Unit

## *Lethrinops longipinnis* n.sp (Fig. 1)

### DIAGNOSIS

A moderate sized species attaining a standard length of about 160mm. Belongs to a group of species within the genus characterised by the possession of a steeply sloping, wedge-shaped snout, a slender lower pharyngeal bone with well spaced teeth, and few (9–14) gill-rakers. Differs from *L. argentea* in having fewer rows of teeth, no flattened pharyngeal teeth and more elongate gill-rakers, and from *L. leptodon* and *L. lethrinus* in gill-raker shape and number, and the absence of any markings other than vertical bars.

### MATERIAL EXAMINED

Measurements based on 21 specimens, 10 males 111–155mm and 11 females 74–133mm S.L. from various parts of southern Lake Malawi. Live colouration and distributional records based on additional specimens. HOLOTYPE: A mature female 128mm S.L. trawled in 40 fathoms, LMTS station Monkey Bay IV (14°02’S, 34°58’E), 30 December, 1974, BMNH 1977.5.24:4.

PARATYPES: 1 female, 133mm S.L. trawled in 38 fathoms off Monkey Bay (14°04’S, 34°58’E), 24 December, 1974 – RUSI 927; 1 male, 156mm S.L. trawled in 58 fathoms, LMTS station Ngusi VA (13°59’S, 34°53’E), 20 April, 1972 – BMNH 1977.5.24:5; 1 immature female 79mm, 1 male 111mm and 1 mature male 134mm S.L. trawled in 12–15 fathoms east of Nkopola Hill (14°19’S, 35°12’E), 9 September, 1968 RUSI 926; 1 mature male 139mm S.L. gill-netted in about 30 fathoms off Monkey Bay (14°03’S, 34°56’E), 20 November, 1968 – MACT 77-24-P-1; 1 male 131mm S.L. trawled in 20 fathoms, LMTS station Mazinzi II

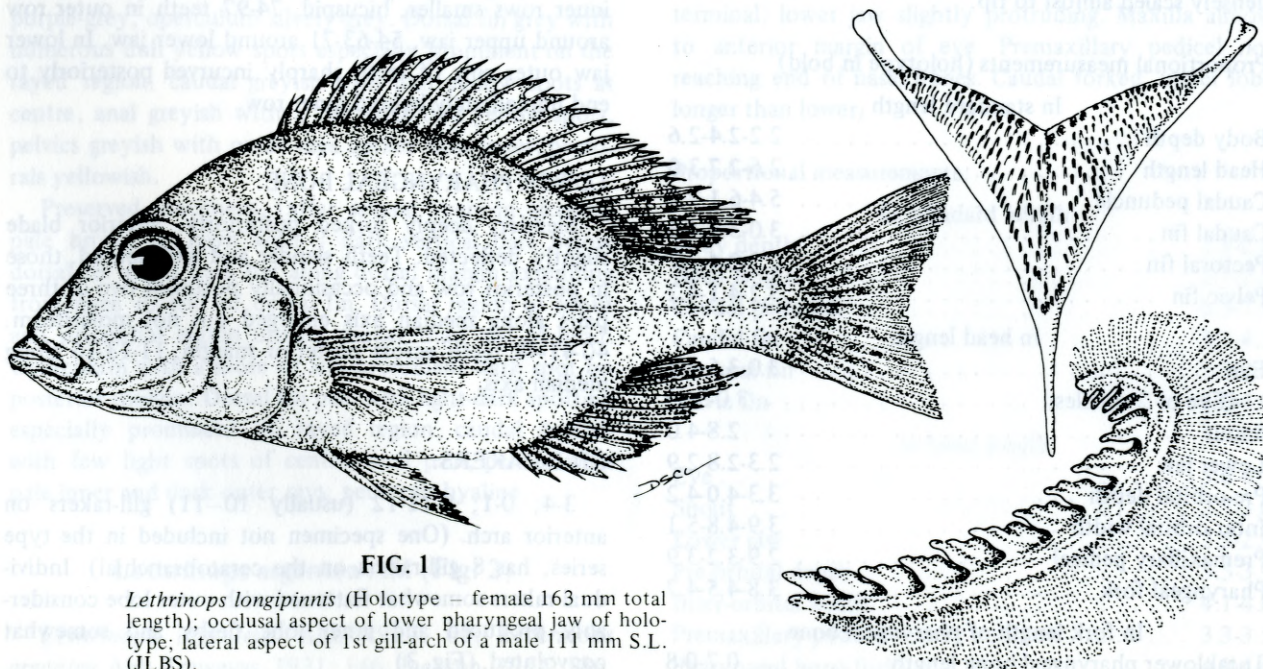


FIG. 1

*Lethrinops longipinnis* (Holotype – female 163 mm total length); occlusal aspect of lower pharyngeal jaw of holotype; lateral aspect of 1st gill-arch of a male 111 mm S.L. (JLBS).

(14°07'S, 34°57'E), 11 May, 1972 — MFRU: 1 male, 120mm S.L. trawled in 15 fathoms east of Nkopola Hill (14°19'S, 35°13'E), 8 May, 1970 — USNM 217506; 1 female, 115mm S.L. trawled in 15 fathoms at same station as preceding specimen — MFRU; 1 breeding male, 132mm S.L. gill-netted in about 20 fathoms near Monkey Bay (14°04'S, 34°56'E), 13 February, 1969 — USNM 217505; 1 female, 119mm S.L. trawled in 15–18 fathoms off Palm Beach (14°20'S, 35°14'E), June, 1965 — QVM 3794; 1 juvenile, 74mm and 1 female, 122mm S.L. trawled with preceding specimen — BMNH 1977.5.24:6-7; 2 females 110 and 126mm S.L. trawled in 20–22 fathoms, LMTS station Ulande IIA (14°13'S, 34°07'E), 12 November, 1971 — USNM 217504; 2 males, 124 and 127mm S.L. trawled in 30 fathoms, LMTS station Mazinzi III (14°06'S, 34°59'E), 22 April, 1970 — QVM 3793; 1 female 128mm S.L. trawled in 40 fathoms, LMTS station Monkey Bay IV (14°02'S, 34°58'E), 30 December, 1974 — MFRU; 1 female 124mm S.L. trawled in 15 fathoms east of Nkopola Hill (14°19'S, 35°13'E), 8 May, 1970 — MFRU; 1 female 130mm S.L. gill-netted in about 25 fathoms off Tumbi Island, Monkey Bay (14°03'S, 34°56'E), 4 November, 1966 — MACT 77-24-P-2.

## DESCRIPTION

Body deep and strongly compressed with the greatest depth at level of 4th – 5th dorsal spines. Dorsal margin steeply arched. Dorsal profile of snout straight and steeply sloping; interorbital region slightly convex in profile; occipital region straight or slightly convex. Mouth terminal, lower jaw slightly protruding, maxilla to between nostril and anterior margin of eye, premaxillary pedicel reaching or almost reaching end of nasal bones. Caudal forked with upper lobe longer than lower, densely scaled almost to tip.

### Proportional measurements (holotype in bold)

In standard length	
Body depth . . . . .	2.2-2.4-2.6
Head length . . . . .	2.6-2.7-3.0
Caudal peduncle . . . . .	5.4-6.1-7.4
Caudal fin . . . . .	3.0-3.7-4.6
Pectoral fin . . . . .	2.2-2.4-2.7
Pelvic fin . . . . .	3.2-4.1-4.2
In head length	
Eye . . . . .	3.0-3.6-4.1
(Eye of 2 smallest . . . . .)	3.0-3.1)
Snout . . . . .	2.8-4.0
Lower jaw . . . . .	2.3-2.8-2.9
Pre-orbital depth . . . . .	3.3-4.0-4.2
Inter-orbital width . . . . .	3.9-4.8-5.1
Premaxillary pedicel . . . . .	2.9-3.2-3.9
Pharyngeal fork . . . . .	3.8-4.5-4.7
In fork length of pharyngeal bone	
Total lower pharyngeal bone length . . . . .	0.7-0.8

Pharyngeal bone width . . . . .	0.9-1.0
Pharyngeal bone depth . . . . .	2.7-3.5-4.0
Pharyngeal bone blade length . . . . .	2.1-2.6-3.0
Pharyngeal bone blade depth . . . . .	3.9-4.5-5.1
Caudal peduncle . . . . .	1.1-1.3-1.5 times as long as deep
Longest ray of caudal . . . . .	1.4-1.6-1.9 times length of shortest ray.

## FINS:

Dorsal **XVI-XVII**, 8(9)-10(11), anal **III**, 8(9)-9(10). Dorsal with well-developed lappets, longest rays extending to between two thirds way along caudal peduncle and base of caudal fin, and in breeding males to one third way along caudal fin. Anal not extending quite as far back as dorsal. Pectorals to base of 3rd – 7th anal rays or to beyond base of anals in breeding males. Pelvics to base of 1st – 3rd anal spines or to base of 2nd anal ray in breeding males. Caudal deeply forked with dorsal lobe longer than lower.

## SQUAMATION:

Scales ctenoid. Upper lateral line 21-24-30, lower 13-15-20; 32-34-35 scales in longitudinal series. 4-7 scales between upper lateral line and base of first dorsal spine. 4-5-6 between pectoral and pelvic, 3-4-5 across cheek. Caudal densely covered with small scales except near margin.

## DENTITION:

In both jaws teeth in 2-3 rows anteriorly (usually 2) and 3 rows laterally. Teeth in outer row of both jaws slender and bicuspid, interspersed with a few tricuspid teeth anteriorly and simple teeth posteriorly. Teeth in inner rows smaller, bicuspid. 74-97 teeth in outer row around upper jaw, 54-63-71 around lower jaw. In lower jaw outer row of teeth sharply incurved posteriorly to end immediately behind inner row.

## LOWER PHARYNGEAL BONE:

Slender, deeply forked posteriorly, anterior blade slightly deflected. Teeth slender and well spaced, those in posterior row and occasionally posterior two or three pairs along median axis enlarged but not molariform. 40-41-48 teeth across posterior margin, 11-13-16 along median axis.

## GILL-RAKERS:

3-4; 0-1; 9-11-12 (usually 10–11) gill-rakers on anterior arch. (One specimen not included in the type series, has 8 gill-rakers on the ceratobranchial). Individual rakers somewhat flattened with outer lobe considerably produced and inner lobe fleshy and somewhat convoluted. (Fig. 3)

## ECOLOGY

### FEEDING:

Although *L. longipinnis* has not been observed feeding, the shape of its head and position of its mouth suggests that it might feed in the same manner as *L. furcifer* (Fryer, 1959) i.e., by taking mouthfuls of sand and ejecting the grains through the gill slits, thereby filtering out food items with the sieve formed by the gill-rakers. Examination of stomach contents show that the diet consists mainly of chironomid larvae though *Corethra* larvae and other small invertebrates are also eaten.

### DISTRIBUTION:

Widely distributed in the southern part of Lake Malaŵi where it is one of the more abundant trawl caught species. Most common in depths of 15–40 fathoms though recorded from as deep as 75 fathoms.

### COLOURATION:

Live females silvery grey with 7 more or less prominent vertical bars below dorsal fin and one or two more on caudal peduncle. Dorsal region of head, snout, inter-orbital region and nape grey-brown, cheek and operculum silvery. Dorsal fin pale grey with clear spots on membranes, caudal yellowish grey with few dark spots at centre, anal clear with dark lappets and dark tips to rays, sometimes with few dark spots on membranes, pelvics yellowish grey with outer rays darker than inner, pectorals lemon yellow.

Live males silvery grey with 7 prominent dark grey vertical bars below dorsal fin. Dorsal region of head, snout, inter-orbital region and nape dark grey, cheek purple-grey, operculum silvery-grey. Dorsal fin grey with numerous dull yellow spots especially prominent on the rayed region, caudal greyish with dull yellow spots at centre, anal greyish with a few large dull yellow spots, pelvics greyish with outer rays darker than inner, pectorals yellowish.

Preserved specimens, (after several years in alcohol) pale brown or fawn with 7 dark vertical bars below dorsal fin and a dark bar along dorsal margin extending from nape to end of dorsal fin. Dorsal region of snout and preorbital region usually darker than rest of head. Operculum with a more or less prominent dark spot on posterior margin. Dorsal fin pale with light-dark spotting especially prominent on rayed region, caudal darkish with few light spots of centre, anal pale, pelvics with pale inner and dark outer rays, pectorals hyaline.

### *Lethrinops argentea* Ahl (Fig. 2)

*Lethrinops argenteus* Ahl, 1927: 60; *Lethrinops argentea* Ahl; Trewavas, 1931: 146; Jackson, 1961: 586.

## DIAGNOSIS

A moderate sized, deep bodied, strongly compressed, species attaining a standard length of at least 185mm. Snout straight, steeply descending. Differs from *L. leptodon* and *L. lethrinus* in the absence of any horizontal markings and from *L. longipinnis* in the coarser buccal and pharyngeal dentition, squat gill-rakers and shorter caudal peduncle.

## MATERIAL EXAMINED

Measurements based on a re-examination of 4 syntypes in the Berlin Museum consisting of two males 141 and 152mm S.L. and two individuals of indeterminate sex 184.5 and 126mm S.L., all from Alt Langenburg at the foot of the Livingstone Mountains near the northern extremity of Lake Malaŵi (9°33'S, 34°09'E).

The exact collection sites, depth from which the specimens were obtained and methods of capture are not known.

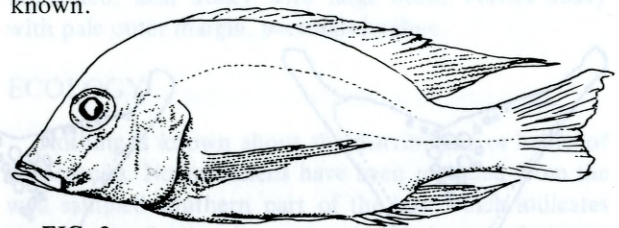


FIG. 2

*Lethrinops argentea* — Traced from photograph of 152 mm S.L. syntype.

## DESCRIPTION

Body deep and strongly compressed. Dorsal margin deeply arched with greatest depth at level of 6th dorsal spine. Snout long, straight and steeply declivous; inter-orbital region straight or slightly convex. Mouth terminal, lower jaw slightly protruding. Maxilla almost to anterior margin of eye. Premaxillary pedicel not reaching end of nasal bones. Caudal forked, upper lobe longer than lower.

### Proportional measurements:

	In standard length
Body depth . . . . .	2.3-2.4
Head length . . . . .	2.7-2.8
Caudal peduncle . . . . .	6.3-7.9
Caudal fin . . . . .	3.7-4.5
Pectoral fin . . . . .	2.5-2.7
Pelvic fin . . . . .	3.0-4.0

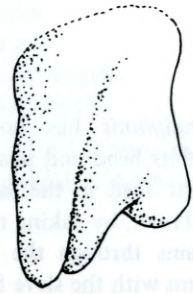
  

	In head length
Eye . . . . .	3.6-4.1
Snout . . . . .	2.7-3.0
Lower jaw . . . . .	2.5-2.9
Pre-orbital depth . . . . .	3.5-3.9
Inter-orbital width . . . . .	4.1-4.6
Premaxillary pedicel . . . . .	3.3-3.5
Pharyngeal bone fork . . . . .	4.3-4.6



A.

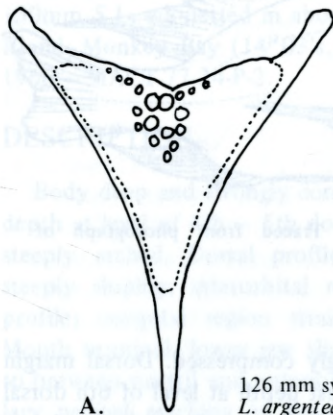
Outer gill-raker from middle of 1st gill arch of  
A. *Lethrinops longipinnis*.



B.

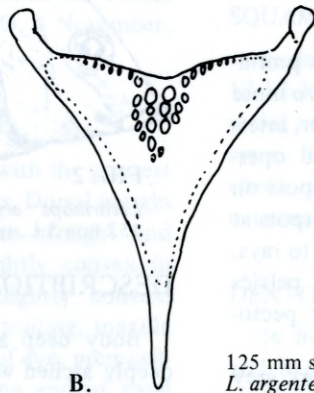
Outer gill-raker from middle of 1st gill arch of  
B. *Lethrinops argentea*.

FIG. 3



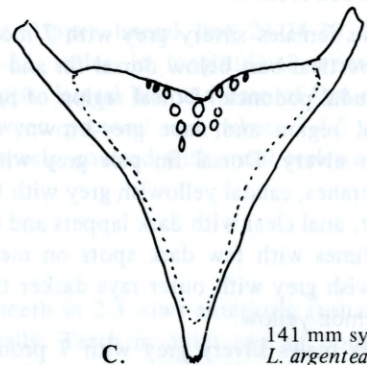
A.

126 mm syntype  
*L. argentea*



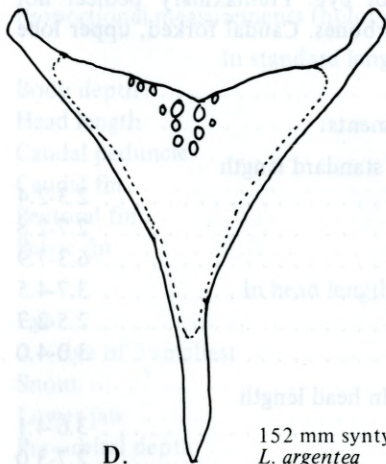
B.

125 mm syntype  
*L. argentea*



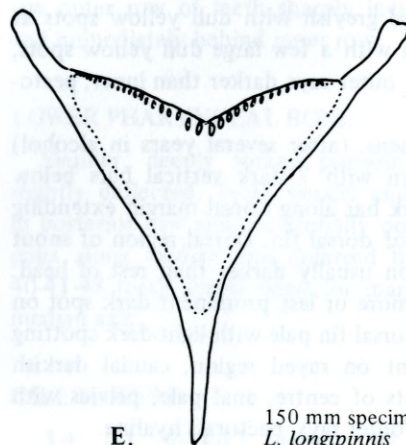
C.

141 mm syntype  
*L. argentea*



D.

152 mm syntype  
*L. argentea*



E.

150 mm specimen  
*L. longipinnis*

FIG. 4

A. - D. Occlusal aspects of the lower pharyngeal bones of the 4 syntypes of *Lethrinops argentea* to show degree of tooth enlargement. Traced from photographs. E. Occlusal aspect of a typical lower pharyngeal jaw of *Lethrinops longipinnis* from the South East Arm of Lake Malawi.

In fork length of pharyngeal bone	
Total lower pharyngeal bone length . . . . .	0.8
Pharyngeal bone width . . . . .	0.9
Pharyngeal bone depth . . . . .	3.3-3.6
Pharyngeal blade length . . . . .	2.6-2.9
Pharyngeal blade depth . . . . .	4.4-4.7

Caudal peduncle 0.9-1.2 times as long as deep  
 Longest ray of caudal 1.4-1.6 times length of shortest ray.

**FINS:**

Dorsal XVI, 9(10)-10(11), anal III, 8(9)-10(11). Dorsal with well-developed lappets. In 3 specimens soft dorsal and anal rounded posteriorly with longest rays to or almost to base of caudal; in 152mm male dorsal rays almost to caudal fork. Pectorals to anal spines or to 2nd anal ray in largest male. Pelvics to just past vent in smaller specimens, to base of 3rd anal spine in largest. Caudal deeply forked, upper lobe longer than lower.

**SQUAMATION:**

Upper lateral line 25-29; lower 16-20; 33-34 scales in longitudinal series; 4 between upper lateral line and base of 1st dorsal spine; 6 between pectoral and pelvic; 4 across cheek.

**DENTITION:**

In both jaws teeth in 3-4 rows anteriorly. Anterior and antero-lateral teeth in outer row of each jaw bicuspid (a few tricuspid in one specimen), posterior teeth simple. Teeth in inner rows unevenly tricuspid. 80-92 teeth in outer row around upper jaw, 58-62 around lower jaw. In lower jaw outer row of teeth sharply incurved posteriorly to end immediately behind inner rows.

**LOWER PHARYNGEAL BONE:**

Moderately slender, anterior blade slightly deflected. Teeth mostly slender and well spaced but a central group of up to 15 enlarged teeth posteriorly. 30-35 teeth across posterior margin, 12-16 along median axis.

**GILL-RAKERS:**

4:9-11 gill-rakers on anterior arch. Individual rakers squat and approximately rectangular with outer lobe not produced (Fig. 3)

**COLOURATION:**

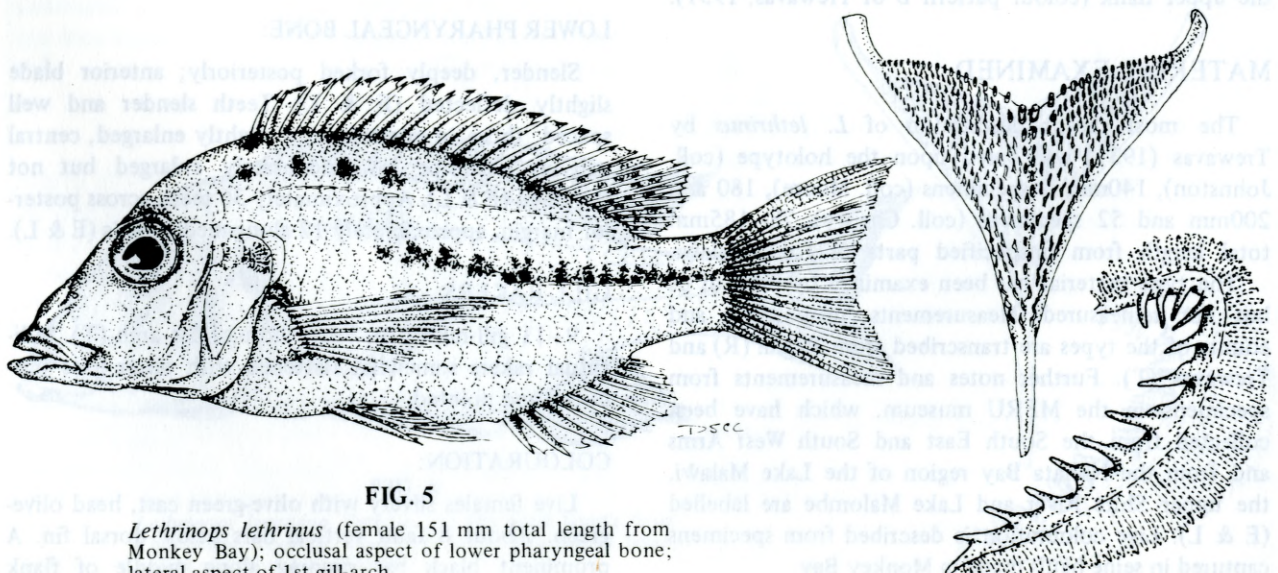
The colouration in life is not known and all four syntypes are badly faded. Preserved colour pale fawn with 7-8 dark vertical bars below dorsal fin. In smaller specimens dorsal, caudal and anal not obviously marked, pelvics and pectorals hyaline. In largest male, dorsal dusky with traces of narrow diagonal white lines, caudal unmarked, anal dusky with large ocelli. Pelvics dusky with pale outer margin, pectorals hyaline.

**ECOLOGY**

Nothing is known about the distribution or habits of this species. No specimens have been recorded from the well sampled southern part of the lake which indicates that its distribution is restricted. Its close similarity to *L. longipinnis* suggests that it may occupy the same niche in the northern part of Lake Malawi that the latter species does in the south.

**NOTE**

Six small specimens (76-108mm S.L.) trawled at a depth of 20 fathoms off the delta of the Rumphu river (10°42'S, 34°12'E) in the northern part of the lake probably belong to this species. They differ slightly from the types in proportions and in having rather more



**FIG. 5**

*Lethrinops lethrinus* (female 151 mm total length from Monkey Bay); occlusal aspect of lower pharyngeal bone; lateral aspect of 1st gill-arch.



rounded snouts through these differences could be attributed to their small size. The proportions of the six specimens which are lodged in the MFRU collection are as follows:

In standard length	
Body depth	2.3-2.7
Head length	2.7-3.0
Caudal peduncle	6.6-7.4
Caudal fin	3.2-3.6
Pectoral fin	2.3-2.6
Pelvic fin	3.7-4.1
In head length	
Eye	2.9-3.5
Snout	3.1-3.7
Lower jaw	2.3-2.7
Pre-orbital depth	3.9-4.6
Inter-orbital width	4.0-4.9
Premaxillary pedicel	3.2-4.1
Caudal peduncle	1.0-1.2 times as long as deep

### **Lethrinops lethrinus (Gunther) (Fig. 5)**

*Chromis lethrinus*, Gunther (1893): 622; *Tilapia lethrinus*, (part) Boulenger (1915): 254; *Lethrinops lethrinus*, Regan (1921): 720; Trewavas (1931): 146; Jackson (1961): 586.

### **DIAGNOSIS**

A moderate sized species attaining a standard length of about 160mm. One of a group of species possessing a steeply sloping, wedge-shaped snout, a slender lower pharyngeal bone with fine, well spaced teeth and relatively few gill rakers. Differs from all other members of this group in possessing a characteristic pattern of a dark longitudinal median bar and two series of spots on the upper flank (colour pattern B of Trewavas, 1931).

### **MATERIAL EXAMINED**

The most recent description of *L. lethrinus* by Trewavas (1931) was based upon the holotype (coll. Johnston), 140mm, 2 specimens (coll. Moore), 180 and 200mm and 52 specimens (coll. Christy), 78-185mm total length from unspecified parts of Lake Malaŵi.

The type material has been examined by both of us but not remeasured. Measurements, proportions and counts of the types are transcribed from Regan (R) and Trewavas (T). Further notes and measurements from specimens in the MFRU museum, which have been collected from the South East and South West Arms and from the Nkhata Bay region of the Lake Malaŵi, the upper Shire River and Lake Malombe are labelled (E & L). Live colouration is described from specimens captured in seine hauls made in Monkey Bay.

### **DESCRIPTION**

Body fairly deep and compressed with greatest depth at level of 4th - 5th dorsal spines. Dorsal profile arched. Snout straight and steeply declivous, sloping at an angle of approximately 50°. Mouth terminal, lower jaw slightly protruding. Maxilla extending to between nostril and anterior margin of eye, premaxillary pedicel to or almost to end of nasal bones, caudal slightly to moderately forked.

#### **Proportional measurements:**

In standard length	
Body depth	2½-3 (T)
Head length	2¾-3 (R)
In head length	
Eye	2¾-4¼ (R)
Pre-orbital depth	3-3½ (T)
Caudal peduncle	1½-1½ times as long as deep (R)

#### **FINS:**

Dorsal XV-XVI, 10-11 (T); anal III, 8-10 (T). Dorsal with well-developed lappets, longest rays to about 2/3 way along caudal peduncle in females and to beyond base of caudal fin in males (E & L). Anal not extending as far back as dorsal. Pectorals to 1st - 5th anal rays; pelvics to 1st - 3rd anal spines (E & L). Caudal slightly to moderately forked, upper lobe longer than lower, densely scaled almost to posterior border.

#### **DENTITION:**

Teeth in 2-3 rows in upper jaw, 3-4 in lower (T). In both jaws anterior teeth in outer row bicuspid anteriorly, simple posteriorly; teeth in inner row tricuspid (E & L). Approximately 70-80 teeth in outer row around upper jaw, 40-50 around lower (E & L). In lower jaw outer row of teeth sharply incurved posteriorly in typical *Lethrinops* fashion.

#### **LOWER PHARYNGEAL BONE:**

Slender, deeply forked posteriorly; anterior blade slightly deflected (E & L). Teeth slender and well spaced, those in posterior row slightly enlarged, central pair in posterior row moderately enlarged but not flattened (E & L). Approximately 36 teeth across posterior margin, approximately 12 along median axis (E & L).

#### **GILL-RAKERS:**

9-11 gill-rakers on lower arm of 1st arch (T). Individual rakers somewhat flattened with outer lobe produced and pointed.

#### **COLOURATION:**

Live females silvery with olive-green cast, head olive-green. About 8 faint vertical bars below dorsal fin. A prominent black bar running along middle of flank

from below 5th – 7th dorsal spine to base of caudal fin; a series of 5–8 black spots just above upper lateral line running from level of operculum to, or almost to, end of spinous dorsal; a series of about 5 black spots along dorsal margin from about 1st to last dorsal spines. Dorsal hyaline with orange-brown reticulation, lappets orange or orange tipped. Caudal dusky with orange-brown spots sometimes merging to form irregular blotches. Anal hyaline with variable number of orange-brown spots sometimes forming rows. Pelvics hyaline with orange tinge. Pectorals hyaline, sometimes orange at base.

Live breeding males with iridescent royal blue head, blue colouration extending to level of 3rd – 4th dorsal spine dorsally and to origin of anal fin ventrally. Occasionally blue cast covering whole body. Body normally silvery gold with orange centres to scales. Dorsal dark in spinous region with white lappets tipped with orange, rayed region dusky with numerous bright orange spots on membranes, tips of rays bright orange. Caudal dusky with outer rays often very dark, numerous orange spots running together to form irregular blotches. Anal dusky to almost black with a variable number of orange spots. Pelvics dark orange with dark outer rays or whole fin dark. Pectorals dusky. Pattern of stripes and spots on flanks as in females.

Preserved material with markings as in live specimens but colours lacking. After longer preservation in alcohol the markings on the flanks may become faint.

Trewavas (1931) noted that there was some variation in flank pattern amongst the type material of *L. lethrinus* and concluded that the differences were dependent upon sex and state of maturity. Examination of further fresh and preserved specimens of this species leads us to believe that these differences are geographical and not related to sex. Male, female and juvenile specimens from the South East arm of Lake Malawi, Lake Malombe and the middle Shire river all show the characteristic 'type B' colour pattern described by Trewavas (1931) and depicted in (Fig. 5). In specimens from the

Nkhata Bay region in the west central part of Lake Malawi the pattern is somewhat modified. The dark line along the middle of the flank curves upwards anteriorly to merge with lower of the two rows of spots and the spots themselves may run together posteriorly to form a stripe.

A single specimen collected from the region of the Bwanje delta (14°15'S, 34°42'E) in the extreme south of the west arm of Lake Malawi has a pattern of markings similar to that displayed by the Nkhata Bay forms.

## ECOLOGY

### FEEDING:

Examination of the gut contents of specimens of *L. lethrinus* from the Nkhata Bay area, the South East arm of Lake Malawi, the upper Shire River and Lake Malombe show that the diet consists very largely of the larvae of chironomids. Other small invertebrates such as ceratopogonid larvae are also eaten. All the guts examined contained large numbers of sand grains and variable amounts of plant detritus.

### DISTRIBUTION:

*L. lethrinus* is very common in the shallower waters of the South East Arm of Lake Malawi, the upper Shire River and Lake Malombe, where it is often taken in seine hauls and in trawl catches from depths of less than 20m. It has also been recorded from the South West Arm and from the central western part of Lake Malawi as far north as Nkhata Bay. The lack of records from further north may reflect insufficient sampling in suitable habitats rather than absence of the species.

*L. lethrinus* is one of the few members of the endemic species flock which is not confined to Lake Malawi and the upper Shire River, but has also been recorded in a number of small perennial rivers on the western shore of Lake Malawi.

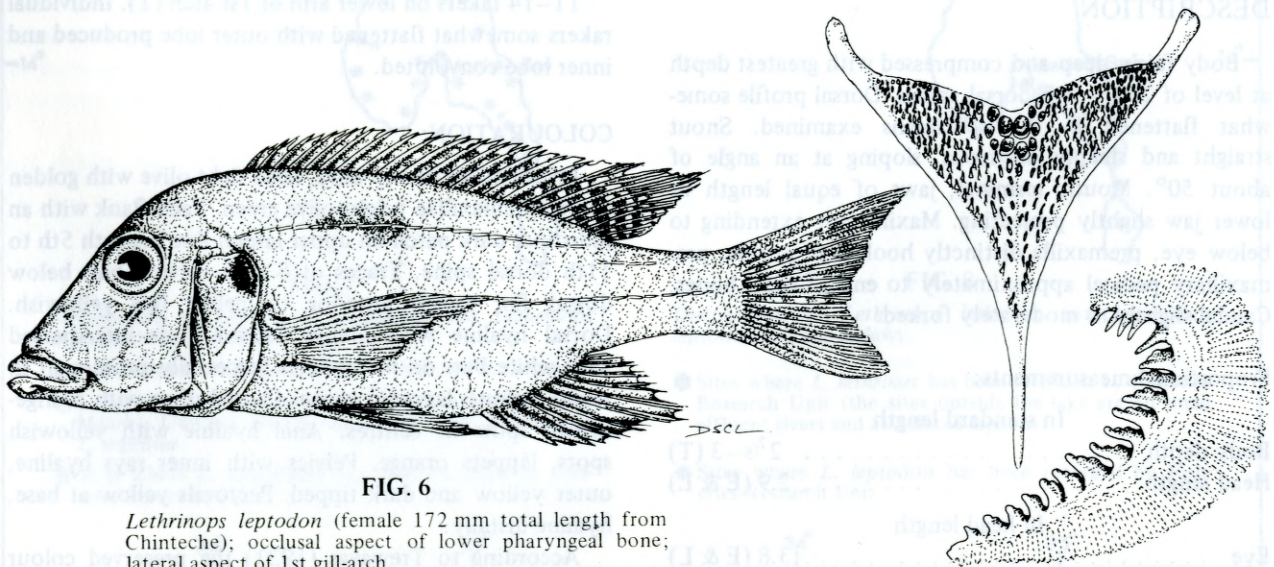


FIG. 6

*Lethrinops leptodon* (female 172 mm total length from Chinteche); occlusal aspect of lower pharyngeal bone; lateral aspect of 1st gill-arch.

## Lethrinops leptodon Regan (Fig. 6)

*Lethrinops leptodon* (part) Regan, (1921): 721; Trewavas, (1931): 147; Jackson, (1961): 586.

### DIAGNOSIS

A moderate sized species attaining a standard length of about 160mm. Resembles *L. lethrinus* but may be distinguished from the latter by its greater number of gill-rakers (11–14 compared with 9–11 in *L. lethrinus*), its possession of enlarged and slightly flattened teeth in the centre of the lower pharyngeal bone, a premaxilla with a hooked profile to the toothed margin (straight in *L. lethrinus*) and a pattern of body markings which is restricted to a single dark patch on the upper lateral line.

### MATERIAL EXAMINED

The original description by Regan (1921) was based upon 8 specimens (coll. Wood) and the redescription by Trewavas (1931) on 7 of the 8 types, 130–195mm and two specimens (coll. Christy) 130 and 160mm total length. Three of the types have been examined by both of us but not remeasured. Measurements proportions and counts of the types are transcribed from Trewavas and labelled (T). Regan's figure cannot be used as his ranges of measurements for *L. leptodon* include those of specimen which Trewavas subsequently transferred to *Lethrinops lunaris*. Additional proportions labelled (E & L) apply to a single female specimen 122mm S.L. captured on a shallow sandy shore near Chinteche (11°50'S, 34°10'E) on the western shore of Lake Malaŵi. Colour notes were made from the above specimen and two other females also from Chinteche. All three specimens have been compared with the types of *L. leptodon*.

### DESCRIPTION

Body fairly deep and compressed with greatest depth at level of 2nd – 5th dorsal spines. Dorsal profile somewhat flattened in the specimens examined. Snout straight and steeply declivous, sloping at an angle of about 50°. Mouth terminal, jaws of equal length or lower jaw slightly projecting. Maxilla not extending to below eye, premaxilla distinctly hooked in profile, premaxillary pedicel approximately to end of nasal bones. Caudal slightly to moderately forked.

#### Proportional measurements:

	In standard length	
Body depth	.....	2 <sup>2</sup> / <sub>5</sub> –3 (T)
Head length	.....	2.9 (E & L)
	In head length	
Eye	.....	3.8 (E & L)

Pre-orbital depth	.....	3–3 <sup>2</sup> / <sub>3</sub> (T)
Inter-orbital width	.....	4.8 (E & L)
Pharyngeal bone fork length	.....	4.0 (E & L)

#### In fork length of pharyngeal bone:

Total lower pharyngeal bone length	.....	0.8 (E & L)
Pharyngeal bone width	.....	1.0 (E & L)
Pharyngeal bone depth	.....	3.7 (E & L)
Pharyngeal bone blade length	.....	2.5 (E & L)
Pharyngeal bone blade depth	.....	5.2 (E & L)

Caudal peduncle 1.4 times as long as deep (E & L)  
Longest ray of caudal 1.4 times length of shortest ray (E & L).

### FINS:

Dorsal XV–XVI, 10–11 (T); anal III, 9–10 (T) caudal slightly to moderately forked with upper lobe longer than lower; densely scaled almost to posterior border.

### DENTITION:

In upper jaw teeth in 3 series anteriorly, in lower 3 anteriorly, 4 anterolaterally. In both jaws teeth in outer row bicuspid anteriorly and anterolaterally, simple posteriorly. Inner teeth tricuspid but with lateral cusps much reduced. 70 teeth in outer row around upper jaw, 67 around lower (E & L). In lower jaw outer tooth row sharply incurved posteriorly to end behind inner rows.

### LOWER PHARYNGEAL BONE:

Fairly slender, deeply forked posteriorly, anterior blade slightly deflected. Teeth mainly slender and well spaced, those in posterior row slightly enlarged. Approximately 9 enlarged and rather flattened teeth in centre of bone (E & L) 44 teeth across posterior margin, 12–13 along median axis (E & L).

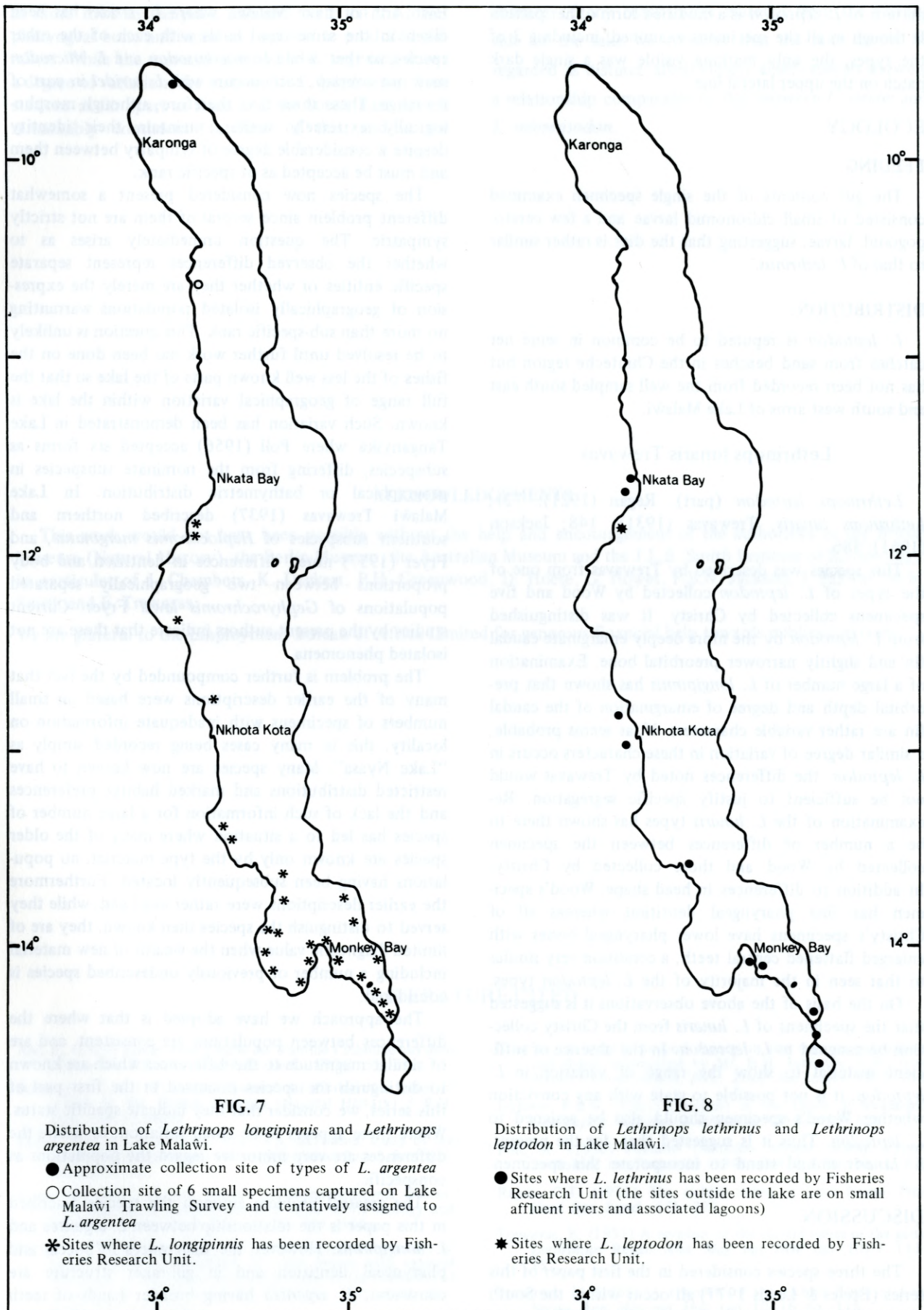
### GILL-RAKERS:

11–14 rakers on lower arm of 1st arch (T). Individual rakers somewhat flattened with outer lobe produced and inner lobe convoluted.

### COLOURATION:

Live females silvery olive, head light olive with golden sheen, premaxillae bright olive green. Each flank with an indistinct dark patch on upper lateral line beneath 5th to 11th dorsal spine. Traces of 8 dark vertical bars below dorsal fin; region anterior to pelvic fins yellowish. Dorsal hyaline with orange brown spots interspersed with white bars on membranes (especially prominent in rayed region), lappets orange. Caudal olive with orange-brown spots at centres. Anal hyaline with yellowish spots, lappets orange. Pelvics with inner rays hyaline, outer yellow and dark tipped. Pectorals yellow at base, hyaline distally.

According to Trewavas (1931) the preserved colour



pattern of *L. leptodon* is a modified form of her pattern B though in all the specimens examined, including 3 of the types, the only marking visible was a single dark patch on the upper lateral line.

## ECOLOGY

### FEEDING:

The gut contents of the single specimen examined consisted of small chironomid larvae and a few ceratopogonid larvae, suggesting that the diet is rather similar to that of *L. lethrinus*.

### DISTRIBUTION:

*L. leptodon* is reputed to be common in seine net catches from sand beaches in the Chintechu region but has not been recorded from the well sampled south east and south west arms of Lake Malaŵi.

## *Lethrinops lunaris* Trewavas

*Lethrinops leptodon* (part), Regan (1921): 721; *Lethrinops lunaris*, Trewavas (1931): 148; Jackson (1961): 586.

This species was described by Trewavas from one of the types of *L. leptodon* collected by Wood and five specimens collected by Christy. It was distinguished from *L. leptodon* by the more deeply emarginate caudal fin and slightly narrower preorbital bone. Examination of a large number of *L. longipinnis* has shown that preorbital depth and degree of emargination of the caudal fin are rather variable characters. If, as seems probable, a similar degree of variation in these characters occurs in *L. leptodon*, the differences noted by Trewavas would not be sufficient to justify specific segregation. Re-examination of the *L. lunaris* types has shown there to be a number of differences between the specimen collected by Wood and those collected by Christy. In addition to differences in head shape, Wood's specimen has fine pharyngeal dentition whereas all of Christy's specimens have lower pharyngeal bones with enlarged flattened central teeth, a condition very similar to that seen in the majority of the *L. leptodon* types.

On the basis of the above observations it is suggested that the specimens of *L. lunaris* from the Christy collection be assigned to *L. leptodon*. In the absence of sufficient material to show the range of variation in *L. leptodon*, it is not possible to state with any conviction whether Wood's specimen should also be assigned to *L. leptodon*. Thus it is suggested that, for the present, *L. lunaris* should stand to incorporate this specimen.

## DISCUSSION

The three species considered in the first paper of this series (Eccles & Lewis 1977) all occur within the South

East Arm of Lake Malaŵi, where *L. stridei* has been taken in the same trawl hauls with each of the other species, so that, while *L. micrentodon* and *L. microdon* may not overlap, each occurs with *L. stridei* in part of its range. These three taxa therefore, although morphologically extremely similar, maintain their identity despite a considerable degree of sympatry between them and must be accepted as of specific rank.

The species now considered present a somewhat different problem since several of them are not strictly sympatric. The question immediately arises as to whether the observed differences represent separate specific entities or whether they are merely the expression of geographically isolated populations warranting no more than sub-specific rank. This question is unlikely to be resolved until further work has been done on the fishes of the less well known parts of the lake so that the full range of geographical variation within the lake is known. Such variation has been demonstrated in Lake Tanganyika where Poll (1956) accepted six forms as subspecies, differing from the nominate subspecies in geographical or bathymetric distribution. In Lake Malaŵi Trewavas (1937) described northern and southern subspecies of *Haplochromis marginatus*, and Fryer (1957) noted differences in dentition and body proportions between two geographically separated populations of *Gephyrochromis lawsi* Fryer. Current studies by the present authors indicate that these are not isolated phenomena.

The problem is further compounded by the fact that many of the earlier descriptions were based on small numbers of specimens with inadequate information on locality, this in many cases being recorded simply as "Lake Nyasa". Many species are now known to have restricted distributions and marked habitat preferences and the lack of such information for a large number of species has led to a situation where many of the older species are known only by the type material, no populations having been subsequently located. Furthermore the earlier descriptions were rather brief and, while they served to distinguish the species then known, they are of limited diagnostic value when the wealth of new material including a number of previously undescribed species is considered.

The approach we have adopted is that where the differences between populations are consistent, and are of similar magnitude to the differences which are known to distinguish the species discussed in the first part of this series, we consider that they indicate specific status. Where there appears to be clinal variation, or where the differences are very minor we regard the populations as conspecific.

The greatest problem amongst the species described in this paper is the relationship between *L. argentea* and *L. longipinnis*. However the differences in buccal and pharyngeal dentition and in gill-raker structure are consistent, *L. argentea* having broader bands of teeth

in more rows in the jaws, enlarged teeth on the lower pharyngeal bone and squat as opposed to produced gill-rakers. While the material assigned to *L. argentea* shows a degree of variation, the material of *L. longipinnis*, from stations as far apart as Bana and the South East Arm is remarkably consistent. In view of this, and in the

absence of any comparative material from the eastern side of the lake we consider that the taxa should be regarded as distinct, albeit closely allied, species showing a relationship comparable to that between *L. stridei* and *L. micrentodon*.

#### ACKNOWLEDGEMENTS

This work would not have been possible without the help and encouragement of the authorities of the British Museum (Natural History), the Berlin Museum, the Australian Museum and the J.L.B. Smith Institute of Ichthyology, in particular of J. Chambers, K. Deckert, P.H. Greenwood, D. Hoese, G. Howes, P.B.N. Jackson, J. Paxton, M.M. Smith and E. Trewavas.

We are grateful to the Employment Bureau of Africa Limited for generous financial help towards publication costs.

#### LITERATURE CITED

- Ahl, E. (1927) Einige neue Fische der Familie Cichlidae aus dem Njassa-See. *S.B. Ges. naturf. Fr. Berl.*, (1926): 51–62.
- Boulenger, G.A. (1915) Catalogue of the fresh-water fishes of Africa in the British Museum (Natural History) 3 B.M. (Nat. Hist.) London.
- Eccles, D.H. & Lewis, D.S.C. (1977) A taxonomic study of the genus *Lethrinops* Regan (Pisces: Cichlidae) Part 1. Ichthyol. Bull. 36 1–12.
- Fryer, G. (1957) A new species of *Gephyrochromis* (Pisces: Cichlidae) from Lake Nyasa with notes on its ecology and affinities. *Revue. Zool. Bot. afr.*, 55: 347–352.
- Fryer, G. (1959) The trophic interrelationships and ecology of some littoral communities of Lake Nyasa with especial reference to the fishes, and a discussion of the evolution of a group of rock-frequenting cichlidae. *Proc. Zool. Soc. Lond.* 132: 153–281.
- Gunther, A. (1893) Second report on the reptiles, batrachians and fishes transmitted by Mr. H.H. Johnston, C.B., from British Central Africa. *Proc. Zool. Soc. Lond.* 1893: 616.
- Jackson, P.B.N. (1961) Checklist of the fishes of Nyasaland. *Occ. Papers Nat. Mus. S. Rhodesia.* (25B): 535–621.
- Poll, M. (1956) Poissons Cichlidae. *Result. Scient. Explor. hydrobiol. lac Tanganika* (1946–1947), 3 fasc 5b: 1–619.
- Regan, C.T. (1921) The cichlid fishes of Lake Nyasa. *Proc. Zool. Soc. Lond.*: 675–727.
- Trewavas, E. (1931) A revision of the cichlid fishes of the genus *Lethrinops* Regan. *Ann. Mag. nat. Hist.* (ser. 10) 7: 133–152.
- Trewavas, E. (1935) A synopsis of the cichlid fishes of Lake Nyasa. *Ann. Mag. nat. Hist.* (ser. 10) 16: 65–118.