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Growth study of white and black anglerfish (*Lophius piscatorius* Linnaeus, 1758; *L. budegassa* Spinola 1807) based on annual sampling in the southern stock (ICES Divisions VIIIc and IXa)

by

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ABSTRACT

The growth study of Anglerfish *Lophius piscatorius* and *L. budegassa* is presented for the southern stock (ICES Divisions VIIIc and IXa). It is the first time that growth of this species has been studied throughout a one year period. Samples were obtained between July 1996 and June 1997 from commercial landings and research surveys (IPIMAR and IEO). The sampling program was established by the EC Study Project 95/038 "Biological Studies of Demersal Fish". A total of 844 and 1049 individuals ranging from 14 cm to 140 cm and from 5 cm to 93 cm in length were aged for *L. piscatorius* and *L. budegassa,* respectively. Ageing was based on growth ring counts of transversal sections of the *illicium* (first dorsal fin ray). Age length keys are presented by quarter with the observed mean length at age and mean weights at age. Estimation of the von Bertalanffy growth parameters by sex and for combined sexes is performed. The obtained growth parameters are for *L. piscatorius* females: $Linf$ = 140.50 cm, k = 0.08 year^{-1}, to = 0.09 year; for males: $Linf$ = 110.50 cm, k = 0.11 year^{-1}, to = 0.26 year and for combined sexes: $Linf$ = 140.50 cm, k = 0.08 year^{-1}, to = 0.23 year. For *L. budegassa* females: $Linf$ = 110.10 cm, k = 0.08 year^{-1}, to = 0.39 year; for males: $Linf$ = 72.90 cm, k = 0.13 year^{-1}, to = 0.36 year and for combined sexes: $Linf$ = 132.40 cm, k = 0.06 year^{-1}, to = 0.04 year. The discussion of these results and the comparison with previous studies is made.

Keywords: Age length keys, ageing, anglerfish, growth, *illicium*, *Lophius budegassa*, *Lophius piscatorius*, monkfish.

INTRODUCTION

The two species of monkfish (*Lophius piscatorius* and *L. budegassa*) in the southern stock (ICES Divisions VIIIc and IXa) are an important component of the by-catches of the European fisheries of both bottom trawl and artisanal fisheries. The mean annual catch of *L. piscatorius* and *L. budegassa* in these divisions over the last five years have reached 2247 and 1876 tonnes, respectively (Anon, 1997). The exploitation assessment of the northern stock (ICES Divisions VIIIa,b and Subarea VII) and southern stock (ICES Divisions VIIIc and IXa) (Figure 1) of this species are made annually within the ICES Working Group on the

Assessment of Southern Shelf Demersal Stocks. While age-length keys are available from 1987 for the northern stock (Anon., 1997) and can be used to obtain age composition of catches, the basis of analytical techniques of assessment, they are not available for either species of southern stock monkfish (*L. budegassa* and *L. piscatorius*).

Growth of these species has been studied in other areas (Fulton, 1902; Guillou and Njock, 1978; Tsimenidis and Ondrias, 1980; Dupouy and Kergoat, 1985; Dupouy *et al.* 1986; Crozier, 1989; Peronnet *et al.* 1992) using otoliths and transversal sections of illicia as anatomical pieces for age determination. The only studies on growth of this species in the southern stock are those of Azevedo, 1992; Duarte *et al.*, 1997 and Landa and Pereda, 1997. Azevedo (1992) estimated, for the first time, growth parameters for the southern stocks of *L. budegassa* and *L. piscatorius* for both sexes combined using Shepherd's Robust Length Composition Analysis, SRLCA (Shepherd, 1987). Growth parameters for *L. budegassa and L. piscatorius* were estimated for the 1993 Working Group based on the mean lengths at age observed in direct reading of illicia and identification of modes in the length frequency distribution found in surveys. From these parameters an attempt was made to estimate age compositions of the catches by slicing length compositions (Anon., 1994). Duarte *et al.* (1997) and Landa and Pereda (1997) studied growth based on mean lengths at age derived from direct reading of transversal sections of illicia and identification of modes in the length composition from research surveys. Nevertheless, the reading technique was not validated for the different age readers of the southern stock of these species. In 1997 a workshop was held on age determination of both species of monkfish, in which the two countries (Spain and Portugal) responsible for monkfish age reading for the southern stock participated together for the first time. The estimations of the readers from the two countries were compared and validated, and reading criteria were established. As a result, this paper presents a first annual study of the growth of both species in the southern stock. Growth in each quarter is shown separately and differences between sexes are presented. A attempt is made to improve the knowledge of the growth of this species and to apply analytical methods for the first time to assess the state of exploitation of the southern stock.

Data were collected by the sampling program established for the EC Study Project 95/038 "Biological Studies of Demersal Fish" (Azevedo and Duarte, 1998; Landa and Pereda, 1998).

MATERIAL AND METHODS

Sampling

Individual age was determined by growth ring counts on transversal sections of the first dorsal fin ray (*illicium*) according to the ageing workshop held in Lorient (Dupouy, 1997). Age was determined for a total of 844 and 1049 illicia of *L. piscatorius* and *L. budegassa* respectively, collected between 1 July 1996 and 30 June 1997 in Spanish and Portuguese waters (ICES Divisions VIIIc and IXa). Most of the illicia come from specimens landed by the Spanish and Portuguese commercial fleets which operate in waters of the area of the study and from specimens collected in research surveys carried out in the same period.

In each quarterly period it was ensured that a minimum of three illicia were collected for each 1 cm length class, attempting to cover the whole length range of the species. Lengths were measured to the lower cm. Table 1 shows the number of illicia and length range covered in each quarter for each sex.

Illicia

Mounting and slicing of illicia was carried out following the methodology described by Duarte *et al.* (1997). Age readings were made by two readers using a binocular microscope (100 X) under reflected light. A video monitor was connected to the microscope to facilitate and validate observations between the two readers. The interpretation of growth rings followed the criteria adopted in the Workshop on anglerfish age determination (Dupouy, 1997).

Growth parameters

Growth parameters were estimated from individual lengths at age, for which a fit was made of the real age of each specimen. This real age of each specimen was estimated as a function of the season of capture. To do so the proportional part of the year (month) in which it was caught was added to the age estimated by reading the illicia. With this adjustment, the differences in the sampling periods, which might introduce an element of error into the estimation of growth parameters, are minimized.
The theoretical growth model to which individual data are fitted is the Von Bertalanffy growth equation (1938).

$$Lt = L\inf(1 - e^{-k(t-t_0)})$$

Lt = length at age class t.
$Linf$ = maximum length the species can reach.
k = instantaneous growth coefficient.
t = age.
t_0 = point at which the Von Bertalanffy curve intersects the abcisas axis.

Growth parameters were estimated by using algorithms for least-squares regression. The values of *Linf* for *L. piscatorius* estimated automatically by the statistical programme are quite different from what was observed experimentally. With the aim of choosing values of *Linf* which fit the lengths at age estimated better than those offered automatically by the statistical programme, the value for *Linf* as the greatest length observed during the period of samplings in the study area, was taken. Considering that practically all of the specimens over 110 cm are females, their growth parameters were also estimated by taking *Linf* as the maximum length observed in unsexed specimens in the sampling period (140.5 cm).

RESULTS

Age-length keys

Tables 2a-h present the combined length-age keys for both sexes for each quarter studied, showing the number of specimens studied by length class and the total by age class. The annual length-age keys of males, females and combined sexes are presented in Table 2i-n. These combined length-age keys include the ages of unsexed specimens mainly from specimens which had been totally gutted when landed and from very young indeterminate specimens. The range of lengths and ages of each quarterly length-age key differs as a function of the number of specimens collected for each quarter. Differences also appear in the ranges of the keys depending on sex.

Mean length at age

Table 3 shows the annual values of the observed mean lengths at age by quarter for combined sexes. A successive progression is observed in the values of mean lengths throughout the quarters, more patently in young ages than in old.

Of all the age classes used in the estimation of mean lengths at age, some include only a few specimens. Generally these were poorly represented age classes: older ages or ages corresponding to quarters with few sampled specimens. Other age classes, although they had a greater number of specimens, did not have specimens throughout the entire length range corresponding to that age, as did the young age classes, which are not totally accessible to the gear. Thus, ages 0 and 1 are not commonly present in commercial landings, which generally include specimens from age 2.

Table 4 shows annual mean lengths, standard deviations and number at age by sex and for sexes combined. Figure 2 presents the annual values for each sex. The observed mean length at age for males is similar to that of females to age 2 for *L. piscatorius* and to age 7 for *L. budegassa*. Thereafter, males are smaller than females at the same age. Very few males older than 13 years and very few females older than 16 years are observed in either species. Practically all unsexed specimens over 13 years are females.

In both species, the mean lengths of females are expected to increase with age, which is observed to age 10. Nevertheless, in ages 11, 12 and over this continued increase is not so clearly and regularly observed. This is due to lower sampling levels, higher standard deviation and lower ageing (Figure 2).

Mean weight at age

Tables 5 and 6 show the annual values of the observed mean total weight and gutted weight at age by quarter for combined sexes. As in the case of mean lengths, mean weights also show a progressive increase through the quarters, more easily seen in the first ages than in older ones.

Tables 7 and 8 show annual mean weights, standard deviations and number of specimens at age by sex and for sexes combined. Figures 3 and 4 present the annual values for each sex. From age 10 and 11 onwards, the mean weight increase is lower than expected. As to mean lengths at age, it is due to a lower sampling levels, a higher standard deviation and a lower ageing.

Growth parameters

Annual growth parameters of the von Bertalanffy growth curve were estimated for each sex and for sexes combined using all observations (Table 9). The growth curves are shown in Figure 5.

DISCUSSION

Age-length keys

This is the first time that annual age-length keys by sex and both sexes combined have been presented, together with quarterly keys for a full year. The range of lengths and ages of both species are well represented. The dispersion of the length ranges of older ages in the keys by sex is due to the slowing down of growth at these ages. In the combined keys, the effect is duplicated on adding the dispersion of males to that of females. Very large specimens of *L. piscatorius* which appear in greater abundance in the combined key of the first quarter mostly correspond to large mature females (Duarte et al., 1998).

Mean length at age

It must be considered that the extremes of the length range and, therefore, of ages are difficult to sample. Thus, for *L. piscatorius* no specimens of age class 0 are found, and so the value of its mean length could not be estimated. Age class 0 of *L.budegassa* and age class 1 of *L. piscatorius* are not fully recruited to the gear and the values of their mean lengths are probably overestimated as they are mostly made up of specimens larger than those found in these classes. Furthermore, in specimens less than 15 cm it is difficult to distinguish sex, and so young ages of each sex have biased values for their mean lengths. Older ages of each sex are composed of a very small numbers of specimens, and as ages have a wide range of lengths, the values of their mean lengths are highly variable.

The progression in the values of mean lengths throughout the quarters, more patently observed in young ages than in old ones, is due to the length range and variability within each age being greater and the number of specimens lower. This is due in turn to the slowing down of growth and to the lower abundance of large specimens.

The results in this paper once more reinforce the different growth pattern by sex, females attaining greater body length. This differential growth by sex, with higher mean lengths at age and longevity in females, may be generated by the distinct maintenance metabolism of the two sexes (Pauly, 1994). This differential growth and longevity are outstanding features of other species, such as Pleuronectiform fish, which, like both species of the genus *Lophius*, are also found in a habitat in direct contact with the bottom, which may be related in some way. Both species have a different age of first maturity as a function of sex, with males reaching maturity between approximately 2 and 3 years before females in both species (Afonso-Dias and Hislop, 1996; Duarte et al., 1998). This earlier start of spawning in males, with its consequently greater metabolic consumption may be the cause of the higher natural mortality in males which limits their longevidad (Pauly, 1994). Nevertheless, these natural causes of the higher mortality of males may not be the only ones. Beverton (1964) suggested that males are more accessible than females in the English North Sea plaice fishery, especially at spawning time. Rijnsdrop (1993) showed that fishing mortality is determined also by the increase in males' vulnerability during the spawning period. The differential sex ratio found throughout the year in *L. piscatorius*, with higher abundance of males in the first months of the year (Duarte et al., 1998) may make them subject to greater fishing mortality in this season owing to their greater vulnerability. Additionally, the scarcity of females in catches in the same season, due to their lower presence in the area, makes them less vulnerables, thus increasing the differences in fishing mortality between the two sexes. This leads to the consideration that the differences in longevity may be due not only to natural mortality (M), as in Scott and Scott (1988) and Cárdenas (1996), but also to differential fishery mortality (F).

Mean weight at age

The reasons for the mean weight increase lower than expected from age 10 and 11 onwards are the same as those referred to for mean lengths.

From weight data it is seen that standard deviation is greater at age for total weight than for gutted weight, probably as a consequence of stomach content and gonad development in the former.

Growth parameters

Regarding sexes combined, including extra individuals for which sex information was not available, the *Linf* estimate is rather higher than expected. The growth curve for sexes combined was expected to be between the female and male growth curves, which is not observed in this estimation (Figure 5) due to the weight of some males in the curve adjustment and the curve of sexes combined greatly influencing large sized indeterminate specimens, almost all females.

On the other hand, *Linf* of this study is higher than the previous estimate, owing to the greater coverage of the length range, and consequently age range, in this case particularly large, than in previous studies. The expected mean length at ages 1 and 2 given by the estimated growth parameters are lower than observed mean lengths (Table 10), possibly due to observed lengths being somewhat overestimated due to the inclusion of specimens larger than the length range at age. The length range and, consequently, age range decisively influence the estimation of the parameters of the growth curve.

If we compare the growth parameters of *L. piscatorius*, we see that Azevedo (1992) presents faster growth than the remaining authors in the two hypotheses suggested. Her samples come from landings of the commercial fleet and the length range of the species is not fully represented in the first ages. This absence of samples in young ages may have influenced the differences found in parameters in comparison with the rest of the authors. With respect to the other papers, it must be considered that the age ranges studied to the present are lower than those presented in the present study. Thus, the ages studied by Duarte *et al.* (1997) are up to 8 years, and up to 12 years in that presented by Landa and Pereda (1997), against the 24 years estimated in the present work. On the other hand, the inverse relationship between *Linf* and *k* also influences the comparison of both parameters. Thus, when similar values of *Linf* are estimated, although there are some differences in mean lengths, the variations in the values of *k* are minimal. For this reason the growth parameters estimated by the different authors who have studied this species in the southern stock are, in general, quite similar. It is observed that for both sexes combined and for *Linf* to have values between 120 and 140 cm, the value of *k* varies between 0.08 and 0.11. It may, therefore, be more useful to compare mean lengths than the growth parameters themselves. Table 10 shows that the values for mean lengths of *L. piscatorius* obtained in the present paper are similar to those estimated by Duarte *et al.* (1997) in the same area of study. In the paper by Landa and Pereda (1997), while mean lengths of the first ages are similar, some differences exist in older ages. This is probably due to the use of a binocular microscope in that work (40 X) for illicia reading, which possibly prevented the differentiation of certain annual rings in the older ages. Following the Ageing Workshop in 1997 the use of 100 X magnification was established for illicia reading, thereby enabling the distinction of all the rings. Thus, using the same reading technique, the values of mean lengths in the present work are practically the same as those presented in the Ageing Workshop of 1997, with the exception of the first ages, in which differences were observed, probably due to the narrow length range taken in the Workshop and to the variability in interpretation.

The growth parameters of *L. budegassa* estimated in the present work show certain differences with respect to those estimated by Duarte *et al.* (1997). *Linf* is greater and the value of *k* lower than in the previous study. These differences are mainly due to the greater age range with which the parameters have been estimated in the present paper. This means that the value of *Linf* is greater and that *k* diminishes. If we look at the mean lengths at age, we see, nevertheless, that there are no great differences between the values observed in both papers, only the value of one year of age approximately.

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Table 1. Number and range of illicia readings for each sex and for combined sexes.

L. piscatorius

Period		Males	Females	Combined
1996 (Q. 3)	Total number	41	42	164
	Min. Length (cm)	16	23	16
	Max. Length (cm)	97	95	112
1996 (Q. 4)	Total number	89	89	239
	Min. Length (cm)	18	15	14
	Max. Length (cm)	86	112	119
1997 (Q. 1)	Total number	85	85	235
	Min. Length (cm)	19	22	19
	Max. Length (cm)	110	122	140
1997 (Q. 2)	Total number	77	93	206
	Min. Length (cm)	23	20	20
	Max. Length (cm)	87	126	126
Total	Total number	292	309	844
	Min. Length (cm)	16	15	14
	Max. Length (cm)	110	126	140

L. budegassa

Period		Males	Females	Combined
1996 (Q. 3)	Total number	70	80	178
	Min. Length (cm)	15	15	7
	Max. Length (cm)	58	78	78
1996 (Q. 4)	Total number	64	74	221
	Min. Length (cm)	17	16	5
	Max. Length (cm)	67	85	85
1997 (Q. 1)	Total number	96	139	329
	Min. Length (cm)	15	20	11
	Max. Length (cm)	60	89	93
1997 (Q. 2)	Total number	118	104	321
	Min. Length (cm)	18	17	11
	Max. Length (cm)	57	82	88
Total	Total number	348	397	1049
	Min. Length (cm)	15	15	5
	Max. Length (cm)	67	89	93

Table 2a

L. piscatorius, 1996 (Q3), combined sexes

Age (years)

Lt (cm)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Total
14.5																									
15.5																									
16.5	1																								1
17.5	1																								1
18.5																									
19.5																									
20.5																									
21.5	1																								1
22.5																									
23.5		1																							1
24.5																									
25.5																									
26.5		1																							1
27.5		1																							1
28.5																									
29.5		2																							2
30.5			1																						1
31.5		1	1																						2
32.5			3																						3
33.5																									
34.5			3																						3
35.5			1	1																					2
36.5			3																						3
37.5				2																					2
38.5				1																					1
39.5				2																					2
40.5																									
41.5				3																					3
42.5				2																					2
43.5				1																					1
44.5					1	1																			2
45.5					3																				3
46.5					2																				2
47.5				1	2																				3
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60.5						1	1																		2
61.5						1	1	1																	3
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64.5								3	1																4
65.5								4																	4
66.5							2	2																	4
67.5							1	2	1																4
68.5							1	2	1																4
69.5								2	1																3
70.5								1	3																4
71.5								1	2																3
72.5									2	1															3
73.5									3	1															4
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76.5									1	2	1														4
77.5										3															3
78.5										1	2														3
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81.5										2	1														3
82.5											1														1
83.5											1														1
84.5										1															1
85.5											1														1
86.5												1			1										2
87.5										1	1														2
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131.5																									
132.5																									
133.5																									
134.5																									
135.5																									
136.5																									
137.5																									
138.5																									
139.5																									
140.5																									
Total	3	8	12	13	9	15	23	22	17	17	14	5	3	1	1	1	1								164

Table 2b

L. piscatorius, 1996 (Q.4), combined sexes

Lt (cm)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Total
14.5	2																								2
15.5	3																								3
16.5	3																								3
17.5	3																								3
18.5	3																								3
19.5	2	1																							3
20.5	3																								3
21.5	2																								2
22.5	2																								2
23.5	1																								1
24.5	2																								2
25.5		1																							1
26.5		3																							3
27.5		2																							2
28.5		2	1																						3
29.5		3																							3
30.5		1																							1
31.5		1	1																						2
32.5		2	1																						3
33.5		1	2																						3
34.5			2	1																					3
35.5		1	2																						3
36.5			2	1																					3
37.5			2	2																					4
38.5			1	2																					3
39.5			1	2																					3
40.5			1	1																					2
41.5			1	2																					3
42.5				2	1																				3
43.5				2																					2
44.5				3																					3
45.5				1	2																				3
46.5					2	1																			3
47.5				1	1	1																			3
48.5				2	1																				3
49.5					2																				2
50.5					1	1	1																		3
51.5					1	1																			2
52.5					2	2																			4
53.5						2	1																		3
54.5						3																			3
55.5						1	2																		3
56.5						1	1																		2
57.5						1	1	1																	3
58.5						1	2																		3
59.5						1	2																		3
60.5							3																		3
61.5							1	2																	3
62.5							2	1																	3
63.5							1	1																	2
64.5							2	1																	3
65.5								1	1																2
66.5							1	1	1																3
67.5							1	1	1																3
68.5							1	2																	3
69.5								1	1	1															3
70.5								1	2																3
71.5								2	1																3
72.5									3																3
73.5									2	1															3
74.5								2		1															3
75.5								1	2																3
76.5									2	1															3
77.5									1	1															2
78.5									2	1															3
79.5									1	2															3
80.5										3															3
81.5										1															1
82.5										2	1														3
83.5											2														2
84.5										1	2														3
85.5										3															3
86.5										1	1	1													3
87.5										1	1	1													3
88.5										2															2
89.5										2	1														3
90.5											2	1													3
91.5											3														3
92.5											2	1													3
93.5											2	1	1												4
94.5											1	1	1												3
95.5											1	1	1												3
96.5																									
97.5													1												1
98.5											1	1													2
99.5																									
100.5														1											1
101.5												1													1
102.5																									
103.5														1											1
104.5																									
105.5																	1								1
106.5																									
107.5																									
108.5																									
109.5																									
110.5																	1								1
111.5																									
112.5														1			1			1					3
113.5																									
114.5																	1								1
115.5																				1					1
116.5																									
117.5																									
118.5																									
119.5																	1								1
120.5																									
121.5																									
122.5																									
123.5																									
124.5																									
125.5																									
126.5																									
127.5																									
128.5																									
129.5																									
130.5																									
131.5																									
132.5																									
133.5																									
134.5																									
135.5																									
136.5																									
137.5																									
138.5																									
139.5																									
140.5																									
Total	26	18	17	22	13	16	22	18	20	24	20	9	4	3			5			2					239

Age (years)

Table 2c

[illegible], 1997 (D,1), combined sexes																									
	Age (years)																								
Lt (cm)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Total
14.5																									
15.5																									
16.5																									
17.5																									
18.5																									
19.5		1																							1
20.5																									
21.5																									
22.5		2																							2
23.5		2																							2
24.5		2																							2
25.5																									
26.5																									
27.5																									
28.5		2																							2
29.5			2																						2
30.5			2																						2
31.5			2	1																					3
32.5			2	1																					3
33.5			2	1																					3
34.5				3																					3
35.5			1	2																					3
36.5				2																					2
37.5				3																					3
38.5				3																					3
39.5					2																				2
40.5				3																					3
41.5					3																				3
42.5				2																					2
43.5					2																				2
44.5				2																					2
45.5					2																				2
46.5				1	2																				3
47.5					1	2																			3
48.5					1	2																			3
49.5						3																			3
50.5					2	1																			3
51.5						3																			3
52.5						3																			3
53.5					1	2																			3
54.5						2	1																		3
55.5						3																			3
56.5						2	1																		3
57.5						3																			3
58.5						1	2																		3
59.5								2																	2
60.5								3																	3
61.5							3																		3
62.5								2																	2
63.5								2	1																3
64.5								2	1																3
65.5							1		1																2
66.5							1	1	1																3
67.5									3																3
68.5									3																3
69.5								1	2																3
70.5								1	2	1															4
71.5								1	1	1															3
72.5								1		1	1														3
73.5								1		1	1														3
74.5								1		2															3
75.5										2															2
76.5									2	1															3
77.5									1	1	1														3
78.5								2			1														3
79.5										3															3
80.5									1	1		1													3
81.5										1		2													3
82.5											1	1	1												3
83.5										1	1														2
84.5										1	1														2
85.5											2	1													3
86.5										1	1	1													3
87.5											1	1	1												3
88.5													2												2
89.5												1	1	1											3
90.5											1		1		1										3
91.5													3												3
92.5											1	2													3
93.5											1		2												3
94.5											2	1													3
95.5										1		1				1									3
96.5													2												2
97.5													1		1										2
98.5												2													2
99.5															1										1
100.5																									
101.5													1						1						2
102.5																									
103.5													1		1	1									3
104.5														2											2
105.5															1	1									2
106.5																2									2
107.5																1									1
108.5																1									1
109.5																1									1
110.5																		1			1				2
111.5																									
112.5																	1								1
113.5																									
114.5																									
115.5																			1						1
116.5																				1					1
117.5																				1					1
118.5																	1		1		1				3
119.5																									
120.5																						1			1
121.5																			1	1					2
122.5																					1				1
123.5																									
124.5																									
125.5																									
126.5																									
127.5																									
128.5																						1			1
129.5																					1				1
130.5																									
131.5																									
132.5																									
133.5																									
134.5																								1	1
135.5																							1		1
136.5																									
137.5																									
138.5																									
139.5																									
140.5																							1		1
Total		9	11	24	16	27	9	20	19	19	16	14	18	3	5	8	2	1	4	3	4	2	2	1	235

Table 2d

L. piscatorius, 1997 (Q.2), combined sexes																									
													Age (years)												
Lt (cm)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Total
14.5																									
15.5																									
16.5																									
17.5																									
18.5																									
19.5																									
20.5	1																								1
21.5																									
22.5																									
23.5		3																							3
24.5																									
25.5		3																							3
26.5		2																							2
27.5																									
28.5		1	2																						3
29.5			2																						2
30.5																									
31.5			1																						1
32.5			1																						1
33.5				2																					2
34.5				1																					1
35.5			1	1																					2
36.5				1																					1
37.5			1	1																					2
38.5				2																					2
39.5				3																					3
40.5				2																					2
41.5				1																					1
42.5					2																				2
43.5				1	1																				2
44.5				1	1	1																			3
45.5					3																				3
46.5					3																				3
47.5					2	1																			3
48.5					1	2																			3
49.5					2	1																			3
50.5						3																			3
51.5						2	1																		3
52.5						3																			3
53.5						2	1																		3
54.5						1	2																		3
55.5						1	1	1																	3
56.5						1	2																		3
57.5						1	1																		2
58.5						1	1	1																	3
59.5						1	2																		3
60.5							2	1																	3
61.5								3																	3
62.5							1	2																	3
63.5								3																	3
64.5								3																	3
65.5								3																	3
66.5								2	1																3
67.5							1	2	1																4
68.5								2	1																3
69.5								1	2																3
70.5								2	1																3
71.5									1	1															2
72.5								1	1	1															3
73.5									3																3
74.5								2	1																3
75.5									1	3															4
76.5								1																	1
77.5								1	2																3
78.5									1		1														2
79.5									1	1		1													3
80.5									1		2														3
81.5										3															3
82.5										2		1													3
83.5									1	1															2
84.5											1	1													2
85.5										1		2													3
86.5																									
87.5										1	1	1	1												4
88.5										1															1
89.5											2	1													3
90.5												2	1												3
91.5											1	1													2
92.5											3														3
93.5										1			2												3
94.5												1	1												2
95.5											2		1	1											4
96.5												2	1												3
97.5														2	1										3
98.5												2													2
99.5													1												1
100.5													3												3
101.5														1											1
102.5															1										1
103.5																1									1
104.5																	1								1
105.5															1										1
106.5																		1							1
107.5																			1						1
108.5																	1								1
109.5																									
110.5																									
111.5																									
112.5																									
113.5																	1	1							2
114.5																									
115.5																									
116.5																									
117.5																									
118.5																									
119.5																									
120.5																									
121.5																				1					1
122.5																									
123.5																									
124.5																									
125.5																									
126.5																						1			1
127.5																									
128.5																									
129.5																									
130.5																									
131.5																									
132.5																									
133.5																									
134.5																									
135.5																									
136.5																									
137.5																									
138.5																									
139.5																									
140.5																									
Total	1	9	8	16	15	21	15	31	19	16	13	15	11	4	3	1	3	2	1	1		1			206

Table 2e

L. budegassa. 1996 (Q.3), combined sexes																							
											Age (years)												
Lt (cm)	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	Total
5.5																							
6.5																							
7.5	1																						1
8.5	2																						2
9.5		1																					1
10.5		2																					2
11.5		3																					3
12.5		1	1																				2
13.5		2	1																				3
14.5			2																				2
15.5			3																				3
16.5			1																				1
17.5			3																				3
18.5			3																				3
19.5			2	1																			3
20.5				2																			2
21.5				4																			4
22.5				3																			3
23.5				4	1																		5
24.5				1																			1
25.5				1	2																		3
26.5					5																		5
27.5					2																		2
28.5					2																		2
29.5					3																		3
30.5						2																	2
31.5					1	2																	3
32.5					2	1																	3
33.5					2	1																	3
34.5						3																	3
35.5						2	1																3
36.5					1	1	1																3
37.5						3																	3
38.5						3																	3
39.5						1	1	1															3
40.5						1	1																2
41.5							3																3
42.5						1	1	1															3
43.5						1		2															3
44.5						1	1	1															3
45.5								2	1														3
46.5							6	2	1														9
47.5								3															3
48.5						1	3																4
49.5							1	1	1														3
50.5							2			1													3
51.5										3	2												5
52.5																							
53.5										4	1												5
54.5											1	1											2
55.5										3	1												4
56.5											1	4											5
57.5											1	2		1									4
58.5											1	2	2										5
59.5											1												1
60.5											3	2											5
61.5																							
62.5										2	1	2											5
63.5											1												1
64.5											1												1
65.5												2											2
66.5																							
67.5																							
68.5																							
69.5																							
70.5														1	1								2
71.5																							
72.5											1												1
73.5																1							1
74.5																	1						1
75.5																							
76.5																							
77.5																							
78.5																		1					1
79.5																							
80.5																							
81.5																							
82.5																							
83.5																							
84.5																							
85.5																							
86.5																							
87.5																							
88.5																							
89.5																							
90.5																							
91.5																							
92.5																							
93.5																							
94.5																							
95.5																							
Total	3	9	16	16	21	24	21	13	3	13	16	15	2	2	1	1	1	1					178

Table 2f

L. budegassa 1996 (Q 4), combined sexes																							
	Age (years)																						
Lt (cm)	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	Total
5.5	1																						1
6.5																							
7.5																							
8.5	1																						1
9.5		1																					1
10.5		1																					1
11.5		3																					3
12.5		1																					1
13.5		1																					1
14.5																							
15.5			4																				4
16.5			2																				2
17.5			4																				4
18.5			2																				2
19.5			2																				2
20.5																							
21.5			3																				3
22.5																							
23.5				1																			1
24.5				1																			1
25.5				2	1																		3
26.5				3																			3
27.5				1	3																		4
28.5				1	2	1																	4
29.5					2	1																	3
30.5					1	2																	3
31.5						3																	3
32.5					2	1																	3
33.5					1	2																	3
34.5						3																	3
35.5						2	1																3
36.5							3																3
37.5							3																3
38.5							2	1															3
39.5							1	2															3
40.5								2	1														3
41.5							1	2															3
42.5								1	1														2
43.5									3														3
44.5								1	2														3
45.5								1	1	1													3
46.5									1	2													3
47.5										2	1												3
48.5										1	2												3
49.5											3												3
50.5									1	1	2		1										5
51.5									1		4												5
52.5										2	1		2										5
53.5										1	1	1	2										5
54.5												1	2	1	1								5
55.5											1		2										3
56.5												2	2			1							5
57.5												1	1	1									3
58.5											1	2	1										4
59.5										1		2	2										5
60.5										1		1	3										5
61.5												2	2										4
62.5												2	2										4
63.5											1	1	1			1							4
64.5											2	2	1										5
65.5											1		3										4
66.5											1		1	3									5
67.5												1	3										4
68.5												1	1	1									3
69.5												1	2	1									4
70.5														1	1								2
71.5											1			1	1								3
72.5														1	1								2
73.5															1	1							2
74.5																							
75.5														1	2		1						4
76.5															1								1
77.5													1	1									2
78.5														2	1								3
79.5															3			1					4
80.5																	1	1		1			3
81.5															1								1
82.5																		1					1
83.5																							
84.5																							
85.5															1		1						2
86.5																							
87.5																							
88.5																							
89.5																							
90.5																							
91.5																							
92.5																							
93.5																							
94.5																							
95.5																							
Total	2	7	17	9	12	15	11	10	11	12	22	20	35	14	14	3	3	3		1			221

Table 2g

L. budegassa. 1997 (Q.1), combined sexes																							
											Age (years)												
Lt (cm)	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	Total
5.5																							
6.5																							
7.5																							
8.5																							
9.5																							
10.5																							
11.5		1																					1
12.5																							
13.5																							
14.5			1																				1
15.5			4																				4
16.5			4																				4
17.5			3																				3
18.5			3	1																			4
19.5				5																			5
20.5				5																			5
21.5				5																			5
22.5				5																			5
23.5				3	2																		5
24.5					5																		5
25.5				1	4																		5
26.5					5																		5
27.5					5																		5
28.5					4	1																	5
29.5					2	3																	5
30.5					1	4																	5
31.5						3																	3
32.5						1	2																3
33.5						4	1																5
34.5						2	3																5
35.5						4	1																5
36.5							5																5
37.5							5																5
38.5							5																5
39.5							1	4															5
40.5								3	2														5
41.5								4	1														5
42.5								1	3	1													5
43.5									5														5
44.5									5														5
45.5									1	4													5
46.5									1	4													5
47.5									5														5
48.5									2	3													5
49.5									1	3	1												5
50.5										5													5
51.5										3	1	1											5
52.5											5												5
53.5										1	4												5
54.5										3	2												5
55.5										1	1	3											5
56.5												4											4
57.5											1	3	1										5
58.5										1	1	2											4
59.5											2	3											5
60.5												2	2										4
61.5											3	1		1									5
62.5											3	2											5
63.5											1	3		1									5
64.5												3	1	1									5
65.5												2	2	1									5
66.5											3	1											4
67.5												2		2									4
68.5												1	1	1	1	1							5
69.5											1		1	2	1								5
70.5													2	2									4
71.5														2	1	1							4
72.5													1	1	1	1	1						5
73.5														2	1	2							5
74.5													1		2	1	1						5
75.5															1		1	1					3
76.5														1	2			2					5
77.5														2		1	1						4
78.5																1	3		1				5
79.5																	1	2	1	1			5
80.5																1		1	1				3
81.5																	1		1				2
82.5																1	1	2		1			5
83.5																	1	1					2
84.5																	1						1
85.5															1			1					2
86.5																							
87.5																			2		1		3
88.5																				1			1
89.5																				1			1
90.5																							
91.5																							
92.5																							
93.5																						1	1
94.5																							
95.5																							
Total		1	15	25	28	22	23	12	26	29	29	33	12	19	11	10	12	10	6	4	1	1	329

Table 2h

L. budegassa. 1997 (Q.2), combined sexes											Age (years)												
Lt (cm)	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	Total
5.5																							
6.5																							
7.5																							
8.5																							
9.5																							
10.5																							
11.5		1																					1
12.5																							
13.5																							
14.5																							
15.5																							
16.5																							
17.5				1																			1
18.5				1																			1
19.5				3																			3
20.5				4																			4
21.5				2	1																		3
22.5				3																			3
23.5				4	2																		6
24.5				3																			3
25.5				5	2																		7
26.5				1	6																		7
27.5					5																		5
28.5					7	1																	8
29.5					6	2																	8
30.5					7	3																	10
31.5					4	2																	6
32.5					3	3	1																7
33.5						5	1																6
34.5					-	5	1																6
35.5						1	1	3															5
36.5							4	1															5
37.5							5																5
38.5							1	4															5
39.5							1	2															3
40.5							3	2															5
41.5							1	2	2														5
42.5								3	3														6
43.5							1	3	1														5
44.5								6	1														7
45.5								5	3														8
46.5									5														5
47.5								1	4														5
48.5									4														4
49.5									2	2													4
50.5									1	2	1												4
51.5										4													4
52.5										4													4
53.5									1	4													5
54.5									1	3	1												5
55.5									4	1													5
56.5									4														4
57.5									1	4													5
58.5									1	3	1												5
59.5									1	2	2												5
60.5								1	1	3													5
61.5									4	3	3												10
62.5									3	1	4												8
63.5										6		1											7
64.5									1		1	1											3
65.5										5	1												6
66.5										3	2												5
67.5												1											1
68.5										2	6												8
69.5											2												2
70.5											1	1											2
71.5												3											3
72.5												4											4
73.5												2	2										4
74.5											2		1										3
75.5												2	4	1									7
76.5													1	2									3
77.5														3	1								4
78.5																							
79.5														3									3
80.5														1									1
81.5														1		2							3
82.5														3									3
83.5														1									1
84.5																1	2						3
85.5																1							1
86.5																							
87.5																1	1						2
88.5																1							1
89.5																							
90.5																							
91.5																							
92.5																							
93.5																							
94.5																							
95.5																							
Total		1		27	43	22	20	33	48	52	27	15	8	15	1	6	3						321

Table 2i

L. [illegible] Annual, males																									
	Age (years)																								
Lt (cm)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Total
14.5																									
15.5																									
16.5	1																								1
17.5	1																								1
18.5	2																								2
19.5	1	1																							2
20.5	1																								1
21.5	2																								2
22.5	1	1																							2
23.5		2																							2
24.5	2																								2
25.5		2																							2
26.5		3																							3
27.5		1																							1
28.5		2	3																						5
29.5		3	3																						6
30.5		1	1																						2
31.5		2	1	1																					4
32.5		1	4																						5
33.5		1	2	3																					6
34.5			2	4																					6
35.5			1	2																					3
36.5			1	2																					3
37.5				5																					5
38.5			1	6																					7
39.5				3	1																				4
40.5				2																					2
41.5				3	2																				5
42.5				1	3																				4
43.5				1	1																				2
44.5				1	1	2																			4
45.5					5																				5
46.5					2	1																			3
47.5					2	2																			4
48.5					1	3																			4
49.5						3																			3
50.5					1	2	1																		4
51.5						6	1																		7
52.5						5																			5
53.5						3	2																		5
54.5						2	2																		4
55.5							4	1																	5
56.5						2	3																		5
57.5						2	4	2																	8
58.5						1	4	1																	6
59.5							3	2																	5
60.5							3	3																	6
61.5							1	4																	5
62.5							2	3																	5
63.5							1	3	1																5
64.5								2	1																3
65.5								4	1																5
66.5							1	2	3																6
67.5								2	4																6
68.5								3	3																6
69.5								2	2	1															5
70.5								1	3	1															5
71.5								3	3	1															7
72.5									6	1	1														8
73.5									3	2	1														6
74.5								4	1																5
75.5									1	3															4
76.5								1	2	1															4
77.5									2	2	1														5
78.5									2		3														5
79.5									1	3															4
80.5										2		1													3
81.5												2													2
82.5											2	1	1												4
83.5																									
84.5											1														1
85.5											1	1													2
86.5												1													1
87.5										1															1
88.5													1												1
89.5												1													1
90.5															1										1
91.5																									
92.5																									
93.5																									
94.5																									
95.5																									
96.5																									
97.5																	1								1
98.5																									
99.5																									
100.5																									
101.5																			1						1
102.5																									
103.5																									
104.5																									
105.5																									
106.5																									
107.5																									
108.5																									
109.5																									
110.5																					1				1
111.5																									
112.5																									
113.5																									
114.5																									
115.5																									
116.5																									
117.5																									
118.5																									
119.5																									
120.5																									
121.5																									
122.5																									
123.5																									
124.5																									
125.5																									
126.5																									
127.5																									
128.5																									
129.5																									
130.5																									
131.5																									
132.5																									
133.5																									
134.5																									
135.5																									
136.5																									
137.5																									
138.5																									
139.5																									
140.5																									
Total	11	20	19	34	19	34	32	43	39	18	10	7	2		1		1		1		1				292

Table 2j

L. piscatorius - Annual, females																									
	Age (years)																								
Lt (cm)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Total
14.5																									
15.5	1																								1
16.5																									
17.5	3																								3
18.5	1																								1
19.5	1	1																							2
20.5	3																								3
21.5	1																								1
22.5	1	1																							2
23.5	1	4																							5
24.5		2																							2
25.5		2																							2
26.5		3																							3
27.5		2																							2
28.5		1																							1
29.5		2																							2
30.5			2																						2
31.5			4																						4
32.5		1	3	1																					5
33.5			1																						1
34.5			3	1																					4
35.5		1	3	2																					6
36.5			4	1																					5
37.5			3	2																					5
38.5				2																					2
39.5			1	3	1																				5
40.5			1	4																					5
41.5			1	3	1																				5
42.5				2																					2
43.5				2	2																				4
44.5				3	1																				4
45.5				1	3																				4
46.5					6																				6
47.5				2	2	1																			5
48.5					2	1																			3
49.5					3	1																			4
50.5					3	4																			7
51.5						1																			1
52.5					1	5																			6
53.5					1	6																			7
54.5						5	1																		6
55.5						3	2																		5
56.5						1	2																		3
57.5						3																			3
58.5						2	1																		3
59.5						2	2																		4
60.5							2	1																	3
61.5							3	1																	4
62.5							1	2																	3
63.5							1	3																	4
64.5								4																	4
65.5							1	2																	3
66.5							2	3																	5
67.5							1	1	1																3
68.5									1																1
69.5								1	2																3
70.5								2																	2
71.5								1	2	1															4
72.5								2		2															4
73.5								1	2																3
74.5								1		3															4
75.5								1	1	1															3
76.5									2	1															3
77.5								1	2	1															4
78.5								2	1	1	1														5
79.5									1	2		1													4
80.5									2	3															5
81.5										4															4
82.5										3		1													4
83.5									1	1	2														4
84.5										3	2	1													6
85.5										2	1														3
86.5											1	1													2
87.5											3	1	1												5
88.5										1			2												3
89.5											2	2		1											5
90.5											1	2	1												4
91.5											3	1	1												5
92.5											4														4
93.5											1	1	3												5
94.5												2	1												3
95.5											2					1									3
96.5												1													1
97.5														2	2										4
98.5																									
99.5													1		1										2
100.5																									
101.5												1													1
102.5																									
103.5														1		2									3
104.5																	1								1
105.5																									
106.5																1									1
107.5																									
108.5																									
109.5																									
110.5																									
111.5																									
112.5																				1					1
113.5																		1							1
114.5																									
115.5																									
116.5																									
117.5																									
118.5																					1				1
119.5																									
120.5																									
121.5																				1					1
122.5																					1				1
123.5																									
124.5																									
125.5																									
126.5																						1			1
127.5																									
128.5																									
129.5																									
130.5																									
131.5																									
132.5																									
133.5																									
134.5																									
135.5																									
136.5																									
137.5																									
138.5																									
139.5																									
140.5																									
Total	12	20	26	29	26	35	19	29	18	29	23	15	10	4	3	4	1	1		2	2	1			209

Table 2k

L. piscatorius. Annual, combined sexes																									
												Age (years)													
Lt (cm)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Total
14.5	2																								2
15.5	3																								3
16.5	4																								4
17.5	4																								4
18.5	3																								3
19.5	2	2																							4
20.5	4																								4
21.5	3																								3
22.5	2	2																							4
23.5	1	6																							7
24.5	2	2																							4
25.5		4																							4
26.5		6																							6
27.5		3																							3
28.5		5	3																						8
29.5		5	4																						9
30.5		1	3																						4
31.5		2	5	1																					8
32.5		2	7	1																					10
33.5		1	4	3																					8
34.5			5	5																					10
35.5		1	5	4																					10
36.5			5	4																					9
37.5			3	8																					11
38.5			1	8																					9
39.5			1	7	2																				10
40.5			1	6																					7
41.5			1	6	3																				10
42.5				6	3																				9
43.5				4	3																				7
44.5				6	2	2																			10
45.5				1	10																				11
46.5				1	9	1																			11
47.5				2	6	4																			12
48.5				2	3	4																			9
49.5					4	4																			8
50.5					4	7	1																		12
51.5					1	8	1																		10
52.5					2	10																			12
53.5					1	9	2																		12
54.5						8	3																		11
55.5						5	6	1																	12
56.5						5	7																		12
57.5						5	5	2																	12
58.5						3	6	1																	10
59.5						2	7	2																	11
60.5						1	6	4																	11
61.5						1	5	6																	12
62.5							5	6																	11
63.5							3	7	1																11
64.5							2	9	2																13
65.5							1	8	2																11
66.5							4	6	3																13
67.5							3	5	6																14
68.5							2	6	5																13
69.5								5	6	1															12
70.5								5	8	1															14
71.5								4	5	2															11
72.5								2	6	3	1														12
73.5								1	8	3	1														13
74.5								6	3	4															13
75.5								1	3	5															9
76.5								1	5	4	1														11
77.5								1	4	5	1														11
78.5								2	3	2	4														11
79.5									2	7		1													10
80.5									2	6	2	1													11
81.5										7	1	2													10
82.5										4	3	2	1												10
83.5									1	2	4														7
84.5										3	4	1													8
85.5										4	3	3													10
86.5										2	2	3			1										8
87.5										3	4	3	2												12
88.5										4	1		3												8
89.5										2	3	4	1	1											11
90.5											3	3	2		1										9
91.5											5	3	3												11
92.5											7	3	1												11
93.5										1	4	1	5												11
94.5											3	3	2												8
95.5										1	4	2	3	1		1									12
96.5												2	3												5
97.5											1		2	2	2		1								8
98.5											1	5													6
99.5													1		1										2
100.5													3	1											4
101.5												2	1	1					1						5
102.5															1										1
103.5													1	1	1	2									5
104.5														2			1								3
105.5														1	2	1	1								5
106.5																2		1							3
107.5																1			1						2
108.5																1	1								2
109.5																1									1
110.5																	1	1			1				3
111.5																									
112.5														1		1	2			1					5
113.5																	1	1							2
114.5																	1								1
115.5																			1	1					2
116.5																				1					1
117.5																				1					1
118.5																	1		1		1				3
119.5																	1								1
120.5																						1			1
121.5																			1	2					3
122.5																					1				1
123.5																									
124.5																									
125.5																									
126.5																						1			1
127.5																									
128.5																						1			1
129.5																					1				1
130.5																									
131.5																									
132.5																									
133.5																									
134.5																								1	1
135.5																							1		1
136.5																									
137.5																									
138.5																									
139.5																									
140.5																							1		1
Total	30	42	48	75	53	79	69	91	75	75	63	44	34	11	9	10	11	3	5	5	4	3	2	1	344

Table 21

L. budegassa. Annual, males																							
	Age (years)																						
Lt (cm)	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	Total
5.5																							
6.5																							
7.5																							
8.5																							
9.5																							
10.5																							
11.5																							
12.5																							
13.5																							
14.5																							
15.5			3																				3
16.5			2																				2
17.5			7																				7
18.5			3	2																			5
19.5			1	3																			4
20.5				4																			4
21.5				9																			9
22.5				5																			5
23.5				10																			10
24.5				5	2																		7
25.5				6	5																		11
26.5				1	5																		6
27.5				1	8																		9
28.5				1	6	1																	8
29.5					11	4																	15
30.5					4	4																	8
31.5					3	4																	7
32.5					2	5																	7
33.5					1	6	1																8
34.5						3	1																4
35.5						4	2																6
36.5					1		4																5
37.5						1	5																6
38.5						1	3	4															8
39.5						1	1	3															5
40.5							4	5	2														11
41.5							3	6	2														11
42.5						1	1	3	6	1													12
43.5						1	1	4	8														14
44.5						1	1	8	6														16
45.5								8	6	4													18
46.5								1	8	5													14
47.5								4	7		1												12
48.5							2		5	2	2												11
49.5									3	4	3												10
50.5							1		2	8	2		1										14
51.5									1	5	5												11
52.5										2	3												5
53.5										4	2		1										7
54.5										1		1											2
55.5												2											2
56.5												1											1
57.5										1	1			1									3
58.5											1												1
59.5												1											1
60.5													1										1
61.5																							
62.5																							
63.5																							
64.5																							
65.5													1										1
66.5																							
67.5													1										1
68.5																							
69.5																							
70.5																							
71.5																							
72.5																							
73.5																							
74.5																							
75.5																							
76.5																							
77.5																							
78.5																							
79.5																							
80.5																							
81.5																							
82.5																							
83.5																							
84.5																							
85.5																							
86.5																							
87.5																							
88.5																							
89.5																							
90.5																							
91.5																							
92.5																							
93.5																							
94.5																							
95.5																							
Total			16	47	48	37	30	48	56	37	20	5	5	1									348

Table 2m

L. budegassa, Annual, females																							
												Age (years)											
Lt (cm)	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	Total
5.5																							
6.5																							
7.5																							
8.5																							
9.5																							
10.5																							
11.5																							
12.5																							
13.5																							
14.5																							
15.5			1																				1
16.5			1																				1
17.5			1	1																			2
18.5			2																				2
19.5			3	1																			4
20.5				4																			4
21.5			3	2																			5
22.5				6																			6
23.5				2	5																		7
24.5					3																		3
25.5				3	2																		5
26.5				3	11																		14
27.5					7																		7
28.5					8	2																	10
29.5					1	2																	3
30.5					5	6																	11
31.5					2	6																	8
32.5					3	1	3																7
33.5					2	6																	8
34.5						8	2																10
35.5						4	2	2															8
36.5						1	9	1															11
37.5						2	5																7
38.5						2	4	1															7
39.5							3	4															7
40.5						1		2	1														4
41.5							2	2	1														5
42.5								3	1														4
43.5								1	1														2
44.5									2														2
45.5										1													1
46.5							6	1		1													8
47.5									2	2													4
48.5						1	1		1	2													5
49.5							1	1	1	1	1												5
50.5							1			1													2
51.5										4	1	1											6
52.5											2		1										3
53.5									1	6	3	1	1										12
54.5										4	4		1	1	1								11
55.5									2	3	2		2										9
56.5									2		1	9	1										13
57.5										1	1	4	2	1									9
58.5										1	1	3	1										6
59.5										2	4	2	1										9
60.5									1	4	3	4	3										15
61.5										1	4	2	1	1									9
62.5									2	3	4	5	1										15
63.5										2	2	4	1	1									10
64.5												3	1										4
65.5										4		1	1	1									7
66.5										1	2	1		3									7
67.5														1									1
68.5										1	2	1		2	1	1							8
69.5											1	1	1										3
70.5														1									1
71.5												1		1	1								3
72.5												1			2								3
73.5														2		2							4
74.5											1				1		2						4
75.5													1				1						2
76.5													1					1					2
77.5														4	1								5
78.5															1	1	2	1	1				6
79.5														2			1	1					4
80.5																1	1						2
81.5																							
82.5														1									1
83.5																							
84.5																							
85.5															1		1						2
86.5																							
87.5																							
88.5																							
89.5																				1			1
90.5																							
91.5																							
92.5																							
93.5																							
94.5																							
95.5																							
Total			11	22	49	42	39	18	18	45	39	44	21	22	9	5	8	3	1	1			397

Table 2n

L. budegassa. Annual, combined sexes																							
	Age (years)																						
Lt (cm)	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	Total
5.5	1																						1
6.5																							
7.5	1																						1
8.5	3																						3
9.5		2																					2
10.5		3																					3
11.5		8																					8
12.5		2	1																				3
13.5		3	1																				4
14.5			3																				3
15.5			11																				11
16.5			7																				7
17.5			10	1																			11
18.5			8	2																			10
19.5			4	9																			13
20.5				11																			11
21.5			3	11	1																		15
22.5				11																			11
23.5				12	5																		17
24.5				5	5																		10
25.5				9	9																		18
26.5				4	16																		20
27.5				1	15																		16
28.5				1	15	3																	19
29.5					13	6																	19
30.5					9	11																	20
31.5					5	10																	15
32.5					7	6	3																16
33.5					3	12	2																17
34.5						13	4																17
35.5						9	4	3															16
36.5					1	1	13	1															16
37.5						3	13																16
38.5						3	8	5															16
39.5						1	4	9															14
40.5						1	4	7	3														15
41.5							5	8	3														16
42.5						1	1	6	7	1													16
43.5						1	1	5	9														16
44.5						1	1	8	8														18
45.5								8	6	5													19
46.5							6	2	8	6													22
47.5								4	9	2	1												16
48.5						1	3		6	4	2												16
49.5							1	1	4	5	4												15
50.5							2		2	9	3		1										17
51.5									1	10	7	1											19
52.5										6	6		2										14
53.5									1	10	6	1	2										20
54.5									1	6	4	2	2	1	1								17
55.5									4	5	3	3	2										17
56.5									4		1	10	2			1							18
57.5									1	4	2	6	2	2									17
58.5									1	4	4	6	3										18
59.5									1	3	5	5	2										16
60.5								1	1	4	3	5	5										19
61.5									4	3	6	3	2	1									19
62.5									3	3	8	6	2										22
63.5										6	3	5	1	1		1							17
64.5									1		4	6	2	1									14
65.5										5	2	4	5	1									17
66.5										3	6	1	1	3									14
67.5												4	3	2									9
68.5										2	6	2	2	2	1	1							16
69.5											3	1	3	3	1								11
70.5											1	1	2	4	2								10
71.5											1	3		3	2	1							10
72.5											1	4	1	2	2	1	1						12
73.5												2	2	2	2	4							12
74.5											2		2		2	1	2						9
75.5												2	4	2	3		2	1					14
76.5													1	3	3			2					9
77.5													1	6	1	1	1						10
78.5														2	1	1	3	1	1				9
79.5														3	3		1	3	1	1			12
80.5														1		1	1	2	1	1			7
81.5														1	1	2	1		1				6
82.5														3		1	1	3		1			9
83.5														1			1	1					3
84.5																1	3						4
85.5															2	1	1	1					5
86.5																							
87.5																1	1		2		1		5
88.5																1				1			2
89.5																				1			1
90.5																							
91.5																							
92.5																							
93.5																						1	1
94.5																							
95.5																							
Total	5	18	48	77	104	83	75	68	88	106	94	83	57	50	27	20	19	14	8	5	1	1	1049

Table 3. Observed mean length (ML), standard deviation (SD) and number (n) at age for combined sexes by quarter.

L. piscatorius

	3rd Quarter			4th Quarter			1st Quarter			2nd Quarter		
Age (years)	ML (cm)	SD (cm)	n	ML (cm)	SD (cm)	n	ML (cm)	SD (cm)	n	ML (cm)	SD (cm)	n
0												
1	18.50	2.16	3	19.00	2.96	26				20.50		1
2	28.00	2.57	6	28.94	3.52	18	24.17	2.71	9	25.39	1.59	9
3	34.00	1.98	12	35.74	3.25	17	31.86	1.77	11	31.63	3.14	8
4	40.65	3.01	13	41.86	3.80	22	38.13	3.89	24	38.56	3.17	16
5	46.61	1.66	9	48.35	2.90	13	45.31	4.00	16	46.10	2.15	15
6	53.43	3.94	15	53.69	3.47	16	52.94	3.28	27	52.36	3.68	21
7	60.37	4.00	23	60.36	4.43	22	60.50	3.71	9	57.90	3.88	15
8	66.41	3.57	22	67.50	4.92	18	66.85	6.12	20	66.31	5.10	31
9	71.50	2.85	17	73.20	3.98	20	70.03	4.50	19	73.87	4.59	19
10	79.32	4.34	17	82.00	5.24	24	78.55	5.89	19	81.13	5.82	16
11	86.64	6.52	14	89.90	4.40	20	85.19	6.82	16	88.50	5.56	13
12	91.67	4.71	6	93.39	4.58	9	89.07	6.13	14	90.10	5.75	15
13	92.17	2.87	3	95.25	1.48	4	92.75	5.20	16	95.68	4.15	11
14	105.50		1	105.50	5.10	3	99.50	7.07	3	98.00	2.18	4
15	86.50		1				99.30	5.23	5	101.83	3.30	3
16	112.50		1				105.38	4.11	8	103.50		1
17	97.50		1	112.50	4.60	5	115.50	3.00	2	108.83	3.68	3
18							110.50		1	110.00	3.50	2
19							114.25	7.66	4	107.50		1
20				114.00	1.50	2	118.50	2.16	3	121.50		1
21							120.25	6.87	4			
22							124.50	4.00	2	126.50		1
23							138.00	2.50	2			
24							134.50		1			
25												
Total			164			239			235			206

L. budegassa

	3rd Quarter			4th Quarter			1st Quarter			2nd Quarter		
Age (years)	ML (cm)	SD (cm)	n	ML (cm)	SD (cm)	n	ML (cm)	SD (cm)	n	ML (cm)	SD (cm)	n
0	7.7	0.6	3	6.5	2.1	2						
1	11.2	1.3	9	11	1.3	7	11		1	11		1
2	16.1	2.1	16	17.5	2.2	17	16.2	1.3	15			
3	21.9	1.6	16	25.6	1.5	9	21.1	1.8	25	22.3	2.5	27
4	28.4	3.3	21	28.9	2.4	12	26.3	1.8	28	28.3	2.5	43
5	36.5	4.6	24	32	2.2	15	31.8	2.3	22	32.2	2	22
6	44.2	4.4	21	37.3	1.7	11	36	2	23	37.3	2.8	20
7	44.8	2.6	13	41	2.4	10	40.2	1	12	42.1	4.7	33
8	46.7	2.1	3	44.7	3.3	11	44.5	2.6	26	51.5	6.8	48
9	54.2	3.8	13	50.7	4.8	12	49.3	3.6	29	58.1	5.6	52
10	58.5	5.4	16	54.8	7.2	22	57.5	5.5	29	64.3	5.6	27
11	58.8	3.4	15	60.6	4.5	20	60.3	4.3	33	70.8	3.4	15
12	58	0	2	60.6	6.2	35	66.2	5.3	12	74.5	1.1	8
13	63.5	9.2	2	69.1	7.2	14	69.6	4.5	19	79	2.6	15
14	70		1	74.8	7.3	14	73.9	4.5	11	77		1
15	73		1	64	8.5	3	74.8	4.3	10	84.3	2.9	6
16	74		1	80	5	3	78.4	3.7	12	85	1.7	3
17	78		1	80.3	1.5	3	79.7	3.3	10			
18							82	4	6			
19				80		1	84.5	4.8	4			
20							87		1			
21							93		1			
Total			178			221			329			321

Table 4. Observed annual mean length (ML), standard deviation (SD) and number (n) at age for each sex and for combined sexes.

L. piscatorius

	Males			Females			Combined sexes		
Age (years)	ML (cm)	SD (cm)	n	ML (cm)	SD (cm)	n	ML (cm)	SD (cm)	n
0									
1	20.50	2.56	11	19.58	2.25	12	19.00	2.86	30
2	27.60	3.52	20	26.30	3.54	20	27.02	3.52	42
3	32.24	2.81	19	34.92	2.99	26	33.73	3.17	48
4	37.85	3.07	34	40.60	3.69	29	39.75	3.92	75
5	44.87	2.68	19	47.15	3.15	26	46.50	3.16	53
6	51.56	3.44	34	53.90	2.99	35	53.03	3.59	79
7	57.81	3.43	32	60.71	3.87	19	59.85	4.21	69
8	65.50	5.23	43	68.22	5.23	29	66.69	5.01	91
9	71.37	4.09	39	75.06	4.54	18	72.18	4.34	75
10	76.44	4.27	18	79.95	4.36	29	80.36	5.54	76
11	79.40	4.13	10	89.02	4.23	23	87.69	6.11	63
12	83.93	3.06	7	90.17	5.45	15	90.66	5.75	44
13	85.50	3.00	2	92.10	3.41	10	93.94	4.63	34
14				97.00	4.97	4	101.14	5.80	11
15	90.50		1	98.17	0.94	3	98.72	6.23	9
16				102.25	4.09	4	105.90	4.32	10
17	97.50		1	104.50	0.00	1	110.68	6.12	11
18				113.50	0.00	1	110.17	2.87	3
19	101.50		1				112.90	7.36	5
20				117.00	4.50	2	117.50	3.21	6
21	110.50		1	120.50	2.00	2	120.25	6.87	4
22				126.50	0.00	1	125.17	3.40	3
23							138.00	2.50	2
24							134.50		1
25									
Total			292			309			844

L. budegassa

	Males			Females			Combined sexes		
Age (years)	ML (cm)	SD (cm)	n	ML (cm)	SD (cm)	n	ML (cm)	SD (cm)	n
0							7.20	1.30	5
1							11.09	1.21	18
2	16.81	1.17	16	18.64	2.10	11	16.63	2.01	48
3	22.57	2.22	47	22.40	2.44	22	22.19	2.36	77
4	28.34	2.40	48	27.46	2.69	49	27.86	2.67	104
5	33.34	3.86	37	33.31	3.62	42	33.32	3.64	83
6	39.29	4.14	30	38.91	4.96	39	38.83	4.51	75
7	42.75	2.74	46	40.36	3.49	18	42.14	3.88	68
8	45.27	2.62	56	50.32	7.36	18	48.42	6.33	88
9	49.49	3.06	37	56.12	6.08	45	54.39	6.21	106
10	51.13	2.78	20	59.13	5.57	39	58.98	6.90	94
11	55.90	1.88	5	60.38	4.58	44	61.98	5.77	83
12	59.00	7.38	5	60.55	6.52	21	63.64	7.33	57
13	57.00		1	69.82	7.45	22	72.04	6.89	50
14				72.33	8.47	9	74.33	5.96	27
15				74.40	4.72	5	75.95	8.05	20
16				77.88	3.68	8	79.47	4.34	19
17				77.67	1.53	3	79.71	2.89	14
18				78.00		1	82.00	4.00	6
19				89.00		1	83.60	4.62	5
20							87.00		1
21							93.00		1
Total			348			397			1049

Table 5. Observed mean total weight (MWt), standard deviation (SD) and number (n) at age for combined sexes by quarter.

L. piscatorius

	3rd Quarter			4th Quarter			1st Quarter			2nd Quarter		
Age (years)	MWt (g)	SD (g)	n	MWt (g)	SD (g)	n	MWt (g)	SD (g)	n	MWt (g)	SD (g)	n
0												
1	116	40	3	120	53	26				152		1
2	371	92	6	388	125	18	234	75	9	278	49	9
3	636	103	12	697	176	17	501	81	11	519	150	8
4	1063	228	13	1095	281	22	851	253	24	894	203	16
5	1550	163	9	1632	275	13	1383	352	16	1453	187	15
6	2311	487	15	2204	395	16	2132	373	27	2084	407	21
7	3260	631	23	3090	638	22	3117	544	9	2755	531	15
8	4258	645	22	4251	870	18	4192	1124	20	4031	878	31
9	5235	579	17	5325	812	20	4732	904	19	5416	946	19
10	7058	1125	17	7386	1304	24	6590	1508	19	7051	1414	16
11	9133	1943	14	9564	1322	20	8315	1830	16	8955	1509	13
12	10637	1638	6	10663	1498	9	9402	1837	14	9416	1653	15
13	10754	944	3	11216	500	4	10507	1699	16	11070	1312	11
14	15749		1	15103	2123	3	12895	2462	3	11792	738	4
15	8957		1				12747	1855	5	13139	1172	3
16	18903		1				15046	1575	8	13710		1
17	12587		1	18112	2111	5	19497	1440	2	15812	1491	3
18							17158		1	16283	1438	2
19							19088	3415	4	15236		1
20				18735	704	2	20956	1098	3	21418		1
21							22017	3543	4			
22							24165	2206	2	23960		1
23							32339	1667	2			
24							30031		1			
25												
Total			164			239			235			206

L. budegassa

	3rd Quarter			4th Quarter			1st Quarter			2nd Quarter		
Age (years)	MWt (g)	SD (g)	n	MWt (g)	SD (g)	n	MWt (g)	SD (g)	n	MWt (g)	SD (g)	n
0	9	3	3	5	3	2						
1	38	28	9	23	9	7				24		1
2	76	24	16	92	38	17	67	28	4			
3	173	46	16	259	41	9	153	42	17	161	65	26
4	363	161	18	403	111	12	277	67	25	349	85	41
5	838	296	24	498	105	14	517	134	20	548	182	21
6	1246	297	19	806	147	10	722	144	21	832	168	19
7	1365	188	13	1096	303	10	961	114	11	1059	243	30
8	1342	115	3	1341	386	10	1344	243	20	1722	724	33
9	2315	666	7	1852	461	9	1780	318	18	3079	1347	33
10	2800	716	9	1745	183	11	2530	911	11	4286	1103	9
11	2946	437	7	3252	966	10	3521	793	13	6027	1591	3
12				2967	1013	19	3966	1086	4	6020	877	2
13	4830	2588	2	4614	1636	8	5261	1222	7	7046	682	5
14				6213	2277	5	5560	1038	3	7480		1
15	5120		1				4380		1			
16				9083	2240	3	6400		1	9500		1
17	6652		1	10000		1						
18							7450		1			
19							7025	4278	2			
20												
21												
Total			148			157			179			225

Table 6. Observed mean gutted weight (MWg), standard deviation (SD) and number (n) at age for combined sexes by quarter.

L. piscatorius

	3rd Quarter			4th Quarter			1st Quarter			2nd Quarter		
Age (years)	MWg (g)	SD (g)	n	MWg (g)	SD (g)	n	MWg (g)	SD (g)	n	MWg (g)	SD (g)	n
0												
1	96	32	3	99	44	26				125		1
2	302	73	6	323	105	18	194	63	9	229	41	9
3	512	82	12	582	147	17	419	68	11	429	124	8
4	848	179	13	916	236	22	718	216	24	739	168	16
5	1229	127	9	1368	231	13	1173	303	16	1201	155	15
6	1818	376	15	1850	333	16	1819	322	27	1723	337	21
7	2549	484	23	2597	538	22	2674	473	9	2278	439	15
8	3314	493	22	3578	735	18	3612	982	20	3334	726	31
9	4059	441	17	4486	687	20	4083	791	19	4480	782	19
10	5443	851	17	6231	1105	24	5713	1327	19	5833	1170	16
11	7010	1465	14	8076	1121	20	7231	1612	16	7408	1249	13
12	8143	1230	6	9008	1271	9	8189	1622	14	7790	1368	15
13	8233	710	3	9478	425	4	9165	1503	16	9158	1086	11
14	11975		1	12778	1804	3	11280	2180	3	9756	611	4
15	6880		1				11148	1643	5	10870	970	3
16	14326	-	1				13187	1397	8	11343		1
17	9609		1	15335	1795	5	17148	1284	2	13083	1234	3
18							15064		1	13472	1190	2
19							16787	3040	4	12606		1
20				15865	598	2	18449	980	3	17723		1
21							19400	3163	4			
22							21317	1972	2	19828		1
23							28640	1497	2			
24							26569		1			
25												
Total			164			239			235			206

L. budegassa

	3rd Quarter			4th Quarter			1st Quarter			2nd Quarter		
Age (years)	MWg (g)	SD (g)	n	MWg (g)	SD (g)	n	MWg (g)	SD (g)	n	MWg (g)	SD (g)	n
0	7	2	3	4	2	2						
1	24	10	7	20	7	7						
2	62	22	16	71	26	13						
3	145	28	16	220	33	9	122	32	9	145	59	23
4	316	133	18	323	73	12	212	45	11	303	64	32
5	702	236	24	408	81	14	351	40	2	449	117	20
6	1119	295	19	679	117	9				719	137	19
7	1178	207	13	758	106	7				936	224	31
8	1195	70	3	1101	359	5	1348	123	9	1417	505	31
9	2081	633	7	2205	431	2	1498	282	13	2089	606	15
10	2398	540	8	1479	135	4	1659	235	4	3410	1035	6
11	2572	328	6	2860	948	5	3083	141	2	4314	970	2
12				2242	492	13				5663		1
13	3940	1895	2	3127	1040	5	4249	605	2	5809	682	4
14				4679	2265	3	4671	590	3			
15	3875		1									
16							5325		1			
17	4609		1									
18							6340		1			
19							8885		1			
20												
21												
Total			144			110			58			184

Table 7. Observed annual mean total weight (MWt), standard deviation (SD) and number (n) at age for each sex and for combined sexes.

L. piscatorius

	Males			Females			Combined sexes		
Age (years)	MWt (g)	SD (g)	n	MWt (g)	SD (g)	n	MWt (g)	SD (g)	n
0									
1	153	53	11	129	41	12	122	52	30
2	353	118	20	302	124	20	327	120	42
3	534	133	19	658	163	26	602	163	48
4	835	189	34	1013	257	29	961	270	75
5	1336	223	19	1535	286	26	1481	284	53
6	1976	367	34	2239	352	35	2150	411	79
7	2717	455	32	3150	573	19	3034	611	69
8	3884	878	43	4413	990	29	4133	896	91
9	4902	790	39	5757	983	18	5146	886	75
10	5941	955	18	6879	1048	29	7000	1389	76
11	6600	951	10	9326	1230	23	8971	1708	63
12	7683	800	7	9707	1664	15	9840	1759	44
13	8091	794	2	10251	1101	10	10840	1507	34
14				11920	1709	4	13397	2164	11
15	9459		1	12252	337	3	12530	2136	9
16				13813	1519	4	15202	1693	10
17	11656		1	14636		1	17295	2626	11
18				18518		1	16963	1247	3
19	13046		1				18354	3289	5
20				20270	2213	2	20373	1579	6
21	16554		1	21976	1038	2	21898	3512	4
22				25219		1	24376	1852	3
23							32126	1651	2
24							29841		1
25									
Total			292			309			844

L. budegassa

	Males			Females			Combined sexes		
Age (years)	MWt (g)	SD (g)	n	MWt (g)	SD (g)	n	MWt (g)	SD (g)	n
0							7	3	5
1							31	22	17
2	83	14	16	113	34	11	82	33	37
3	175	60	46	175	68	22	175	62	68
4	351	113	46	327	107	47	340	109	96
5	618	261	37	627	241	41	620	249	79
6	894	288	29	920	307	38	909	292	69
7	1159	251	44	1010	267	18	1110	260	64
8	1350	261	49	2059	867	17	1532	577	66
9	1813	265	28	2967	1307	39	2485	1158	67
10	1825	234	18	3544	1095	22	2770	1191	40
11	2670	184	2	3585	1215	29	3545	1173	33
12	2813	955	5	3278	1226	18	3371	1313	25
13	2470		1	5481	1601	18	5392	1626	22
14				5703	1818	7	6136	1793	9
15				4750	523	2	4750	523	2
16				9017	2351	3	8630	2023	5
17				6652		1	8326	2367	2
18				7450		1	7450		1
19				10050		1	7025	4278	2
20									
21									
Total			321			335			709

Table 8. Observed annual mean gutted weight (MWg), standard deviation (SD) and number (n) at age for each sex and for combined sexes.

L. piscatorius

	Males			Females			Combined sexes		
Age (years)	MWg (g)	SD (g)	n	MWg (g)	SD (g)	n	MWg (g)	SD (g)	n
0									
1	123	43	11	110	35	12	98	42	30
2	287	98	20	258	106	20	265	98	42
3	438	111	19	563	140	26	488	133	48
4	692	160	34	866	220	29	782	221	75
5	1116	190	19	1314	245	26	1206	232	53
6	1664	315	34	1917	302	35	1754	337	79
7	2302	393	32	2699	492	19	2479	502	69
8	3314	764	43	3782	850	29	3381	736	91
9	4201	691	39	4935	843	18	4214	729	75
10	5110	838	18	5898	899	29	5739	1144	76
11	5689	835	10	7998	1056	23	7363	1408	63
12	6642	705	7	8326	1428	15	8080	1450	44
13	7002	700	2	8792	946	10	8904	1243	34
14				10226	1468	4	11014	1787	11
15	8210		1	10510	290	3	10299	1763	9
16				11852	1305	4	12505	1398	10
17	10158		1	12558		1	14234	2170	11
18				15893		1	13960	1030	3
19	11395		1				15110	2719	5
20				17399	1901	2	16779	1306	6
21	14526		1	18864	892	2	18041	2906	4
22				21651		1	20091	1533	3
23							26509	1368	2
24							24615		1
25									
Total			292			309			844

L. budegassa

	Males			Females			Combined sexes		
Age (years)	MWg (g)	SD (g)	n	MWg (g)	SD (g)	n	MWg (g)	SD (g)	n
0									
1									
2									
3	135	49	19	145	60	13	139	53	32
4	298	73	23	260	66	20	280	72	43
5	414	79	11	466	142	11	440	115	22
6	763	143	10	669	119	9	719	137	19
7	1012	216	26	762	224	7	959	238	33
8	1225	181	33	1848	628	11	1381	436	44
9	1561	209	17	2056	693	14	1785	542	31
10	1550	202	6	2991	1173	8	2373	1142	14
11				3793	815	5	3793	815	5
12				3501	1972	3	3501	1972	3
13				5289	1001	6	5289	1001	6
14				4671	590	3	4671	590	3
15									
16				7208	1756	3	7208	1756	3
17									
18				6340		1	6340		1
19				8885		1	8885		1
20									
21									
Total			145			115			260

Table 9. Annual von Bertalanffy growth parameters for each sex and combined sexes.

L. piscatorius

Sex	*Linf* (cm)	*k* (year^{-1})	*to* (year)	r^2	n	Lt min (cm)	Lt max (cm)	Age min (y)	Age max (y)
males	110.500	0.108	0.255	0.945	292	16	110	1	21
females	140.500	0.081	0.089	0.970	309	15	126	1	22
combined	140.500	0.080	0.232	0.958	844	14	140	1	24

L. budegassa

Sex	*Linf* (cm)	*k* (year^{-1})	*to* (year)	r^2	n	Lt min (cm)	Lt max (cm)	Age min (y)	Age max (y)
males	72.900	0.125	0.360	0.963	348	15	67	2	13
females	110.100	0.075	0.397	0.950	397	15	89	2	19
combined	132.400	0.056	0.039	0.959	1049	5	93	0	21

Table 10a. Annual mean lengths at age and von Bertalanffy growth parameters for combined sexes.

L. piscatorius

	Present work	Present work	Workshop (1997)	Duarte et al. (1997)	Landa & Pereda (1997)
	expected	observed	observed	observed	observed
Linf	140.500			121.54	132.05
k	0.080			0.102	0.11
to	0.232			0.032	0.66
Age (years)	ML (cm)	ML (cm)	ML (cm)	ML (cm)	ML (cm)
1.5	13.55	19.00	9.10	17.50	18.85
2.5	23.31	27.02	18.10	30.10	30.94
3.5	32.32	33.73	26.80	36.50	37.75
4.5	40.63	39.75	35.10	42.90	43.97
5.5	48.31	46.50	43.10	50.50	53.61
6.5	55.40	53.03	50.70	58.00	63.21
7.5	61.94	59.85	58.00	64.60	69.72
8.5	67.98	66.69	65.00	71.50	79.17
9.5	73.56	72.18	71.70		86.03
10.5	78.70	80.36	78.20		102.50
11.5	83.45	87.69	84.30		97.70
12.5	87.84	90.66			102.50
13.5	91.89	93.94			
14.5	95.62	101.14			
15.5	99.07	98.72			
16.5	102.26	105.90			
17.5	105.20	110.68			
18.5	107.91	110.17			
19.5	110.42	112.90			
20.5	112.73	117.50			
21.5	114.87	120.25			
22.5	116.84	125.17			
23.5	118.66	138.00			
24.5	120.34	134.50			
25.5	121.89				

Table 10b. Annual mean lengths at age and von Bertalanffy growth parameters for combined sexes.

L. budegassa

	Present work	Present work	Workshop (1997)	Duarte et al. (1997)
	expected	observed	observed	observed
Linf	132.400			101.700
k	0.056			0.080
to	0.039			-0.200
Age (years)	ML (cm)	ML (cm)	ML (cm)	ML (cm)
1.5	6.90	11.09	4.30	9.30
2.5	13.80	16.63	11.00	16.40
3.5	20.20	22.19	17.50	23.00
4.5	26.30	27.86	23.60	29.00
5.5	32.10	33.32	29.40	34.60
6.5	37.60	38.83	35.00	39.80
7.5	42.70	42.14	40.20	44.50
8.5	47.60	48.42	45.20	48.90
9.5	52.20	54.39	50.00	53.00
10.5	56.60	58.98	54.50	56.70
11.5	60.70	61.98	58.90	60.20
12.5	64.60	63.64	63.00	63.40
13.5	68.30	72.04	66.90	66.30
14.5	71.80	74.33	70.60	69.00
15.5	75.10	75.95		71.60
16.5	78.20	79.47		73.90
17.5	81.20	79.71		
18.5	84.00	82.00		
19.5	86.60	83.60		
20.5	89.10	87.00		
21.5	91.50	93.00		

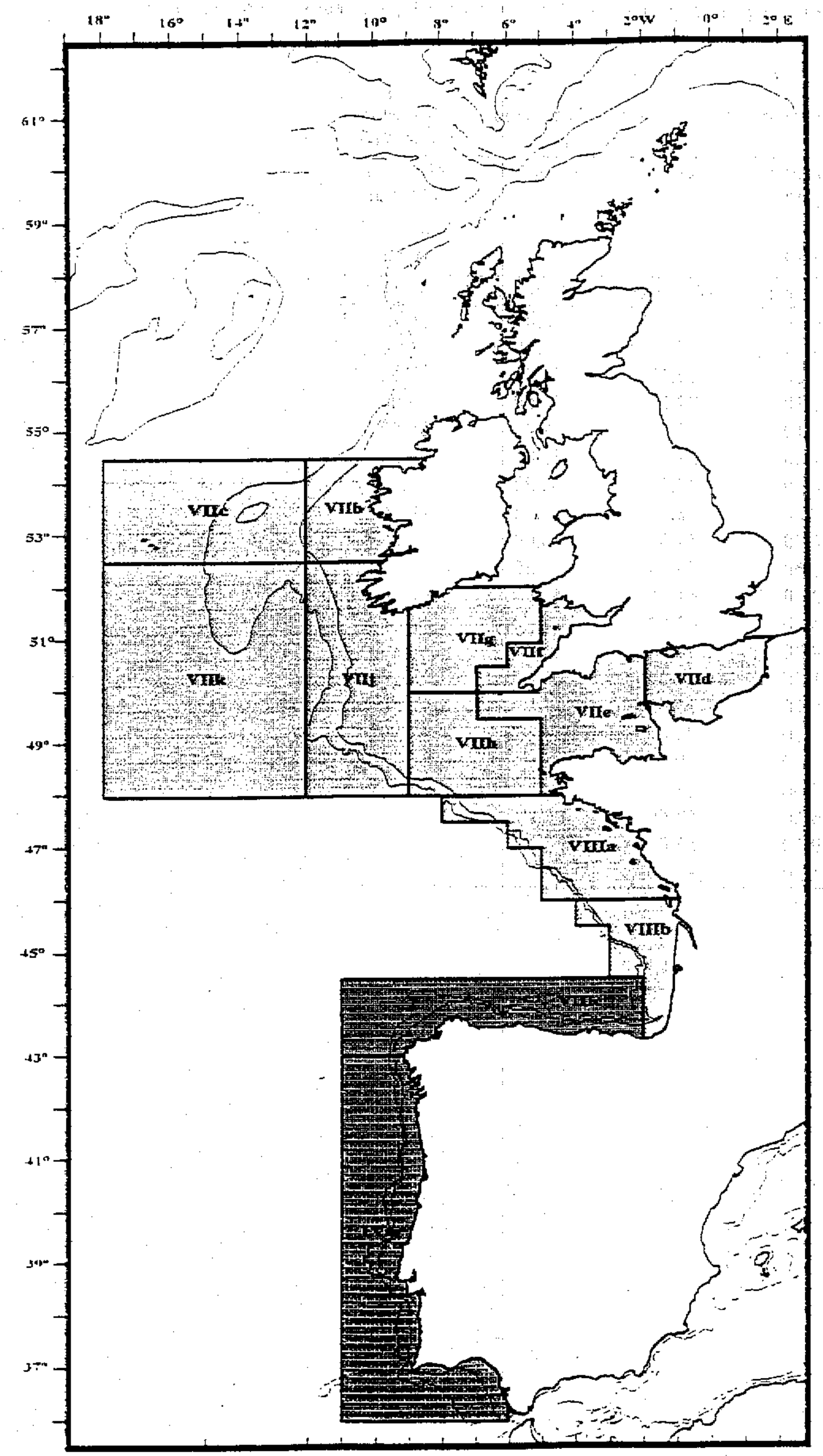


Figure 1. Anglerfish stocks geographical areas: ☐ northern stocks (ICES Divisions VIIb-k and VIIIa,b); ■ southern stocks (ICES Divisions VIIIc and IXa).

Figure 2a: Mean total length at age.

L. piscatorius

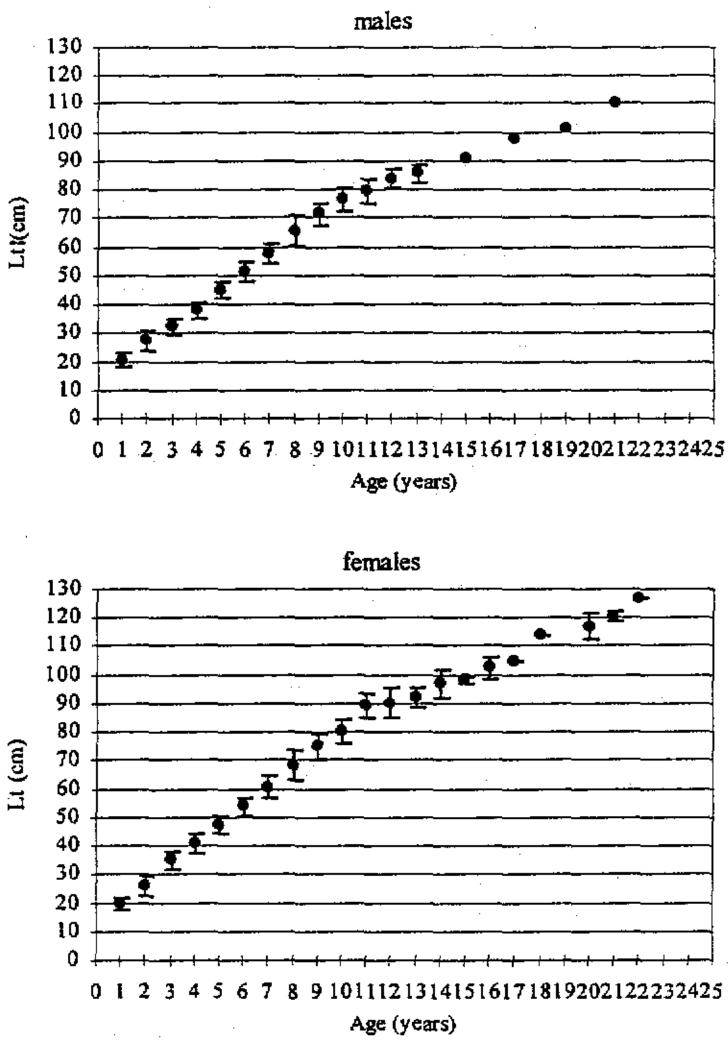
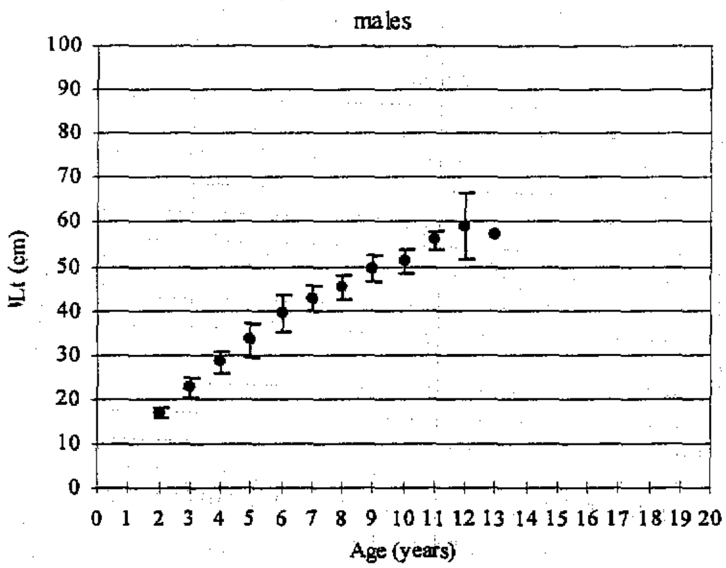


Figure 2b: Mean total length at age.

L. budegassa



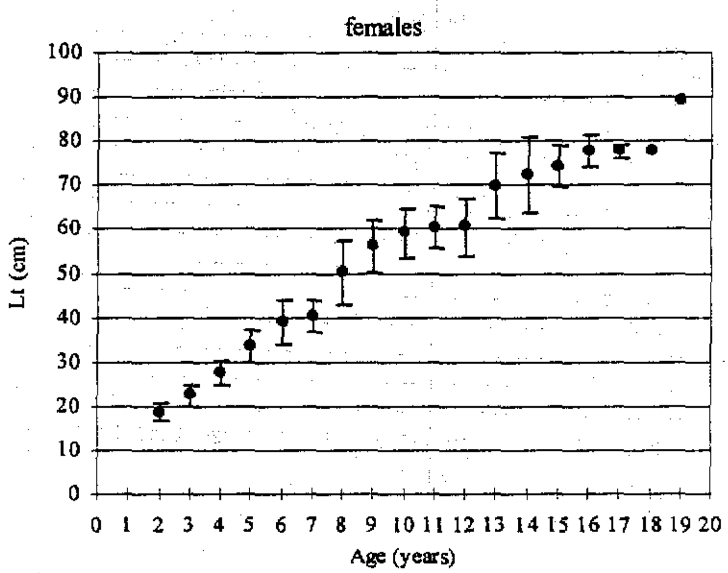
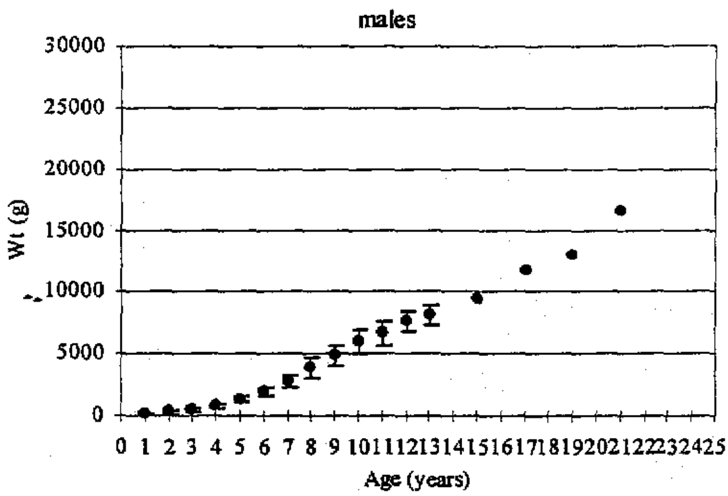


Figure 3a: Mean total weight at age.

L. piscatorius



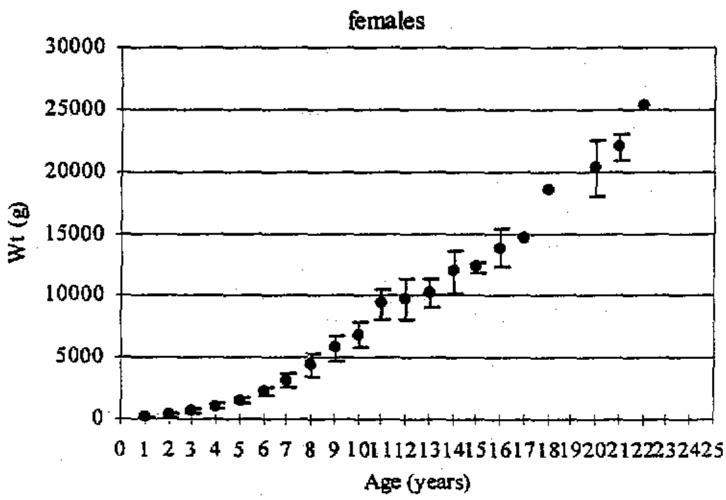


Figure 3b: Mean total weight at age.

L. budegassa

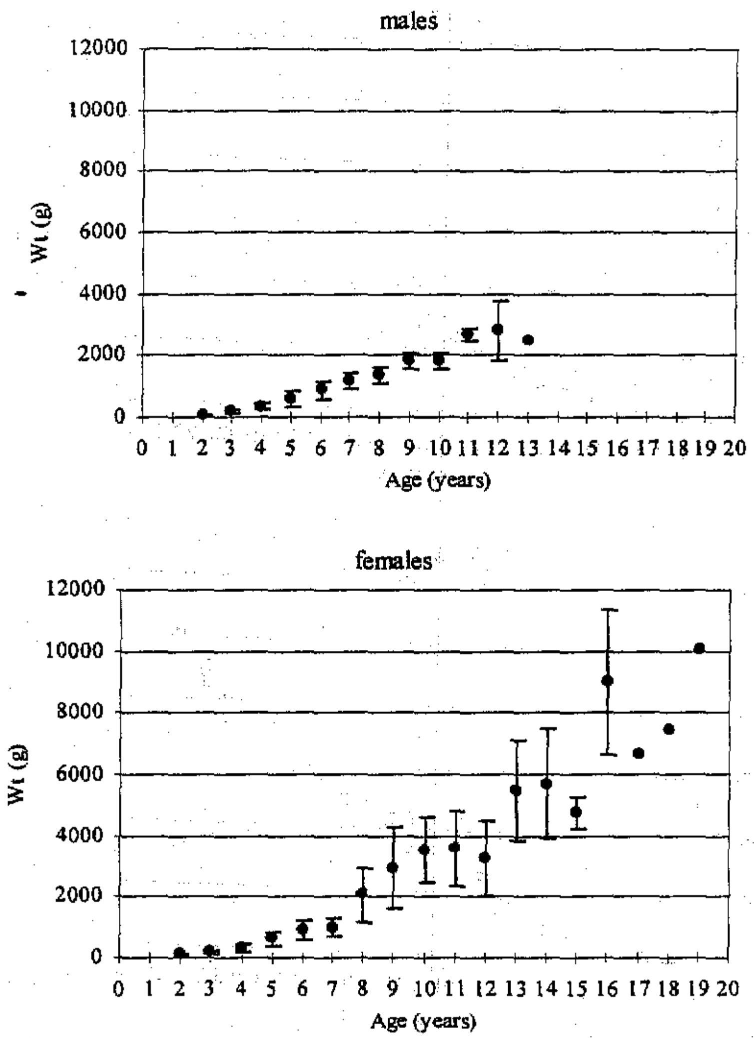


Figure 4a: Mean gutted weight at age.

L. piscatorius

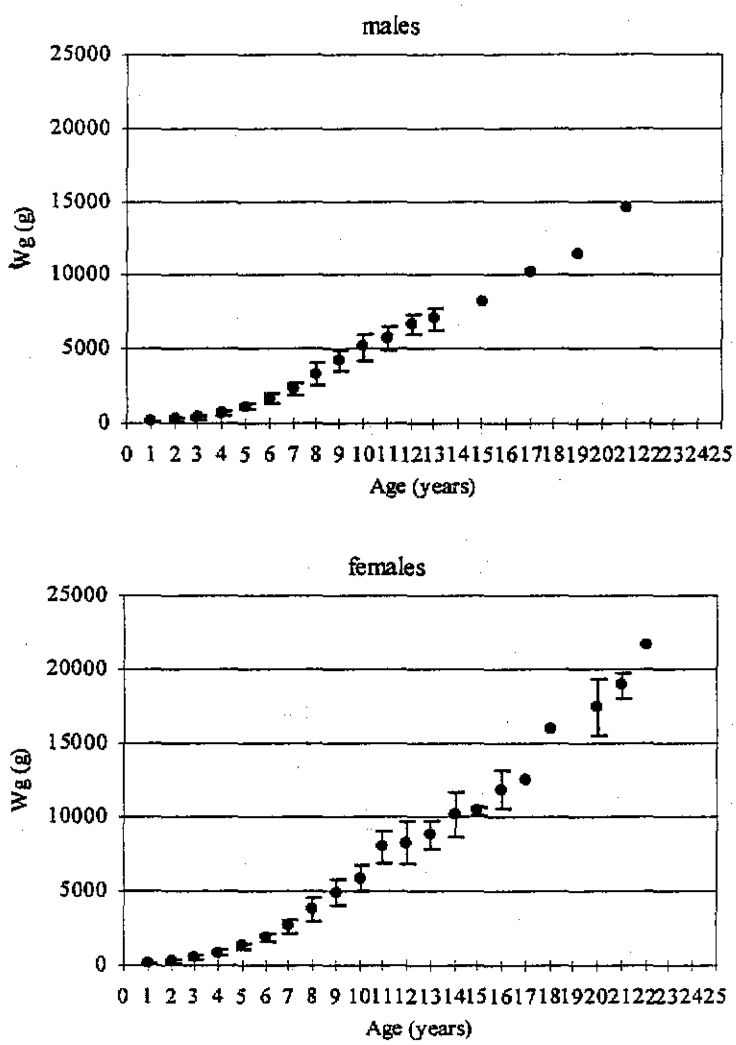
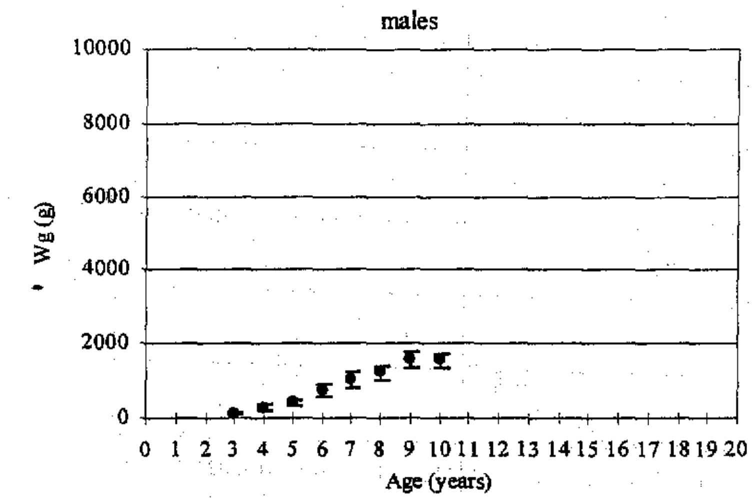


Figure 4b: Mean gutted weight at age.

L. budegassa



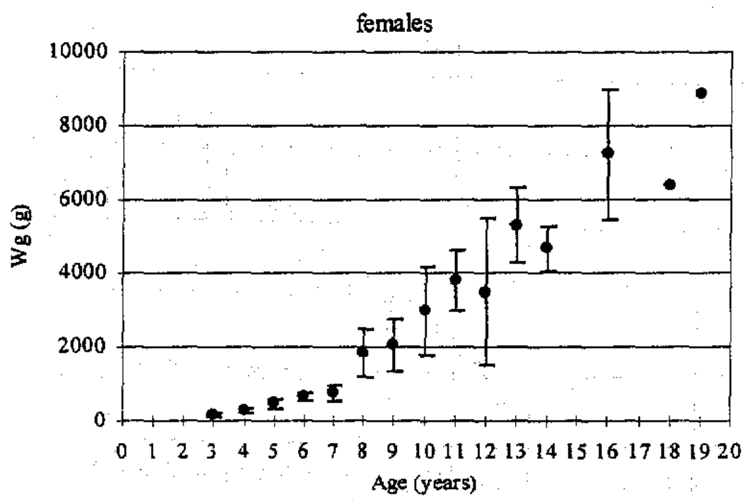
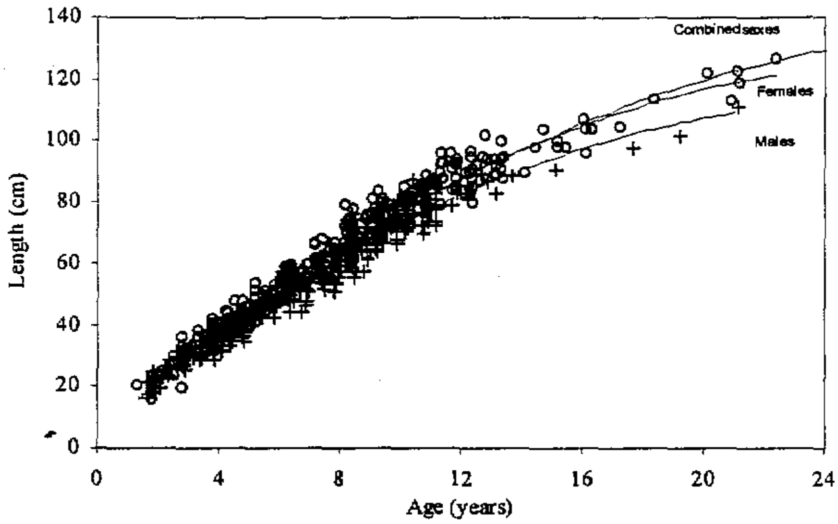


Figure 5: Growth curves by sex and combined sexes.

L. piscatorius



L. budegassa