

MORPHOLOGICAL CHARACTERS AND MERISTIC COUNTS
IN TWO ANGLERFISHES, *LOPHIUS BUDEGASSA* AND *L. PISCATORIUS*
(OSTEICHTHYES: LOPHIIDAE) FROM TUNISIAN COASTAL WATERS
(CENTRAL MEDITERRANEAN)

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ABSTRACT

The paper examines and presents morphological characters and meristic counts carried out in anglerfishes *Lophius budegassa* Spinola, 1807 and *L. piscatorius* Linnaeus, 1758 collected off the Tunisian coast. Mean-comparisons of morphometric indexes and meristic counts show an interspecific variation between the two species and sexual dimorphism in both species. Both positive and regular increase of illicium length for both species could be considered as an improvement of this fishing device with special regard to age.

Key words: *Lophius budegassa*, *Lophius piscatorius*, morphometric indexes, meristic counts, Tunisia, central Mediterranean

CARATTERI MORFOLOGICI E CONTEGGI MERISTICI IN DUE SPECIE DI RANA
PESCATRICE, *LOPHIUS BUDEGASSA* E *L. PISCATORIUS* (OSTEICHTHYES: LOPHIIDAE),
DI ACQUE COSTIERE TUNISINE (MEDITERRANEO CENTRALE)

SINTESI

L'articolo esamina e presenta i caratteri morfologici e i conteggi meristici di due specie di rana pescatrice *Lophius budegassa* Spinola, 1807 e *L. piscatorius* Linnaeus, 1758, pescate al largo della costa tunisina. I confronti degli indici morfometrici e dei conteggi meristici indicano variazioni interspecifiche e dimorfismo sessuale in entrambe le specie. La crescita positiva e regolare della lunghezza dell'illicio in entrambe le specie può venire considerata come un miglioramento dell'attrezzatura di pesca, tenendo in considerazione anche l'età dell'animale.

Parole chiave: *Lophius budegassa*, *Lophius piscatorius*, indici morfometrici, conteggi meristici, Tunisia, Mediterraneo centrale

INTRODUCTION

Two anglerfishes are known to occur off the Tunisian coast such as off other northern African areas (Dieuzeide *et al.*, 1954; Collignon & Aloncle, 1972; Caruso, 1986), the black anglerfish, *Lophius budegassa* Spinola, 1807, and the white anglerfish, *Lophius piscatorius* Linnaeus, 1758. Although the occurrence of both species have been locally reported from northern Tunisian area and southward, in the Gulf of Gabès (Bradaï *et al.*, 2004), they have not been studied thoroughly as yet, probably because they had previously been considered by-catch species by the local fishermen. During the last decade, production of both species considerably increased, with *L. budegassa* and *L. piscatorius* targeted for local consumption, although assigned mainly for exportation.

Specimens collected throughout Tunisian coastal waters have given us an opportunity to report on distributional aspects and some morphometric and meristic characters on both species collected in the area in order to clarify the distinctions between *L. piscatorius* and *L. budegassa*, considering that both species are generally confused under the same vernacular name throughout the Mediterranean Sea.

MATERIAL AND METHODS

Statistical data on both species production in Tunisian waters were provided by a public fishery institution known as 'Direction Générale des Pêches et de l'Aquaculture'. Investigations were conducted at the fishing sites off the Tunisian coast between November

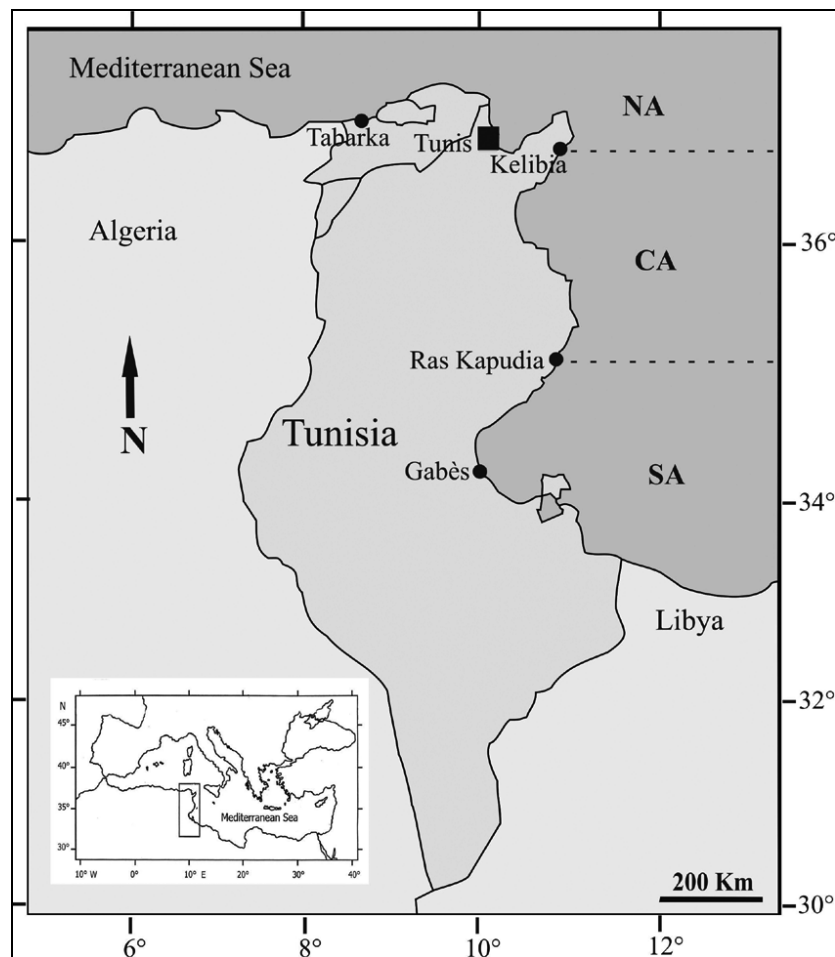


Fig. 1: Map of the Mediterranean Sea showing Tunisia, and map of the Tunisian coast showing the landing sites of both *L. budegassa* and *L. piscatorius* in three fishing areas: northern area (NA) from Tabarka to Kelibia, central area (CA) south of Kelibia to Ras Kapudia, and southern area (SA) south of Ras Kapudia to the Libyan border.

Sl. 1: Zemljevid Sredozemskega morja z označeno Tunizijo in zemljevid tunizijskih obrežnih voda z lokacijami v treh območjih, kjer so bili ujeti primerki male morske spake *L. budegassa* in morske spake *L. piscatorius*: severno območje (NA) od Tabarke do Kelibie, osrednje območje (CA) južno od Kelibie do Ras Kapudie, in južno območje (SA) južno od Ras Kapudie do libijske meje.

2004 and December 2005. Eighteen morphometric characters were measured to the nearest millimetre as follows (see figure 3): total length (TL), standard length (SL), head length (HL), eye diameter (ED), pre-orbitary length (PrOL), post-orbitary length (PsOL), inter-orbitary length (IOL), maxillary length (ML), pre-pectoral length (PPectL), pre-first dorsal fin length (PD1), pre-second dorsal fin length (PD2), pre pelvic length (PPelL), pre-anal length (PaL), pectoral length (PecL), pectoral height (PecH), body depth (BD), illicium (IL), esca length (EsL).

From these measurements, we have calculated the following morphometric indexes: SL/TL, BD/SL, HL/SL, PPectL/SL, PD1/SL, PD2/SL, PPelL/SL, PaL/SL, PecL/SL, PecH/SL, IL/SL, ED/HL, PrOL/HL, PsOL/HL, IOL/HL, ML/HL, IL/HL and EsL/IL.

Some meristic counts were used, such as: number of rays in first and second dorsal fins, pectoral fin, pelvic fin, anal fin, caudal fin, and number of vertebrae.

Two specimens, one female *Lophius budegassa* and one female *Lophius piscatorius*, are preserved in the ichthyological collection of the Faculté des Sciences de Tunis, with catalogue number FST-LOPH-piscatorius-01 and FST-LOPH-budegassa-01, respectively.

Test for significance ($p < 0.05$) were performed using Student's t test, Snedecor's F test, and chi-square test (χ^2). Linear regression was performed following log transformation of the data. Correlations were assessed by least-squares regression.

RESULTS

Production and sample description

Landings for both craft fishing and trawl fleets were monthly registered between 1997 and 2003 for every landing site (Fig. 1), mainly concerning the northern area, from Tabarka to Kelibia, and the central area, south of Kelibia to Ras Kapudia. Unfortunately, the southern area production, from Ras Kapudia to the Libyan border, was not included in the statistical data (see Table 1), although both species were landed in the area

according to Ben Othman (1971, 1973) and Ktari-Chakroun & Azouz (1971). Consequently, the local production was probably underestimated. During a period of seven years, the anglerfish production ranged approximately between 30 and 47 tons per year off the Tunisian coast (Tab. 2). Specimens were mainly collected by trawl due to their benthic life. Moreover, it appears that landings were significant mainly in June and in November (Fig. 2). Of the 543 specimens examined, 416 were *Lophius budegassa* (135 males, 280 females, and one hermaphrodite), and 127 *Lophius piscatorius* (34 males, 76 females, 17 undetermined). The monthly collection of *L. budegassa* and *L. piscatorius* collected off the Tunisian coast are given in Table 3. In our sample, females significantly outnumbered males in *L. budegassa* ($\chi^2 = 50.56$; $df = 1$) and *L. piscatorius* ($\chi^2 = 16.03$; $df = 1$).

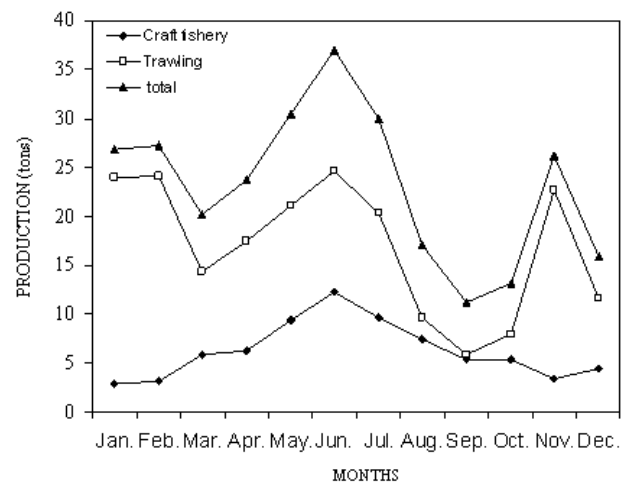


Fig. 2: Monthly production (in tons) of anglerfishes from Tunisian coastal waters between 1997 and 2004.
Sl. 2: Mesečni ulov (v tonah) morskih spak v tunizijskih obrežnih vodah med letoma 1997 in 2004.

Tab. 1: Production of anglerfishes (in tons) by fishing year for the three Tunisian areas between 1997 and 2004.

Tab. 1: Ulov morskih spak (v tonah) po posameznih ribolovnih letih v treh tunizijskih območjih med letoma 1997 in 2004.

Areas	Craft fishery		Trawling fishery		Total	
	Landings (t)	%	Landings (t)	%	Landings (t)	%
Northern area	70.84	94.1	195.94	96.2	266.78	95.6
Central area	4.46	5.9	7.78	3.8	12.24	4.4
Southern area			0.03	0	0.02	0
Total	75.30	100.0	203.75	100.0	279.04	100.0
	27.0%		73.0%		100%	

Tab. 2: Total production of anglerfishes (in tons) per year and by fishing year method.
Tab. 2: Skupni ulov morskih spak (v tonah) na leto in po metodi ribolovnega leta.

Years	Craft fishery landings (t)	Trawl landings (t)	Total
1997	13.25	20.22	33.47
1998	5.92	23.89	29.81
1999	5.80	32.45	38.25
2000	7.92	38.81	46.73
2001	11.52	23.98	35.50
2002	14.52	28.09	42.61
2003	10.86	30.65	41.51

General morphology

Body dorso-ventrally flattened, head strongly depressed about as wide as long (Figs. 4, 5). Gills openings extending below and behind pectoral fin. Medially, there are three modified dorsal fin rays, the anterior one called the 'lure' or illicium, ending with a fleshy appendage or esca, simple-pennant-like flap in *L. budegassa*, composed of two broad, flattened, leaf-like blades

in *L. piscatorius* (Fig. 6). Third dorsal cephalic dorsal spine short in *L. budegassa*. Dorsal spines II–VI long and stout and bearing numerous well-developed, twisted tendrils in *L. piscatorius*. *L. piscatorius* body brownish to greyish slightly marbled, pectoral black edged with dark notches, peritoneum light while in *L. budegassa* body uniformly brownish or greyish, with dark striped tail, peritoneum dark (Fig. 5).

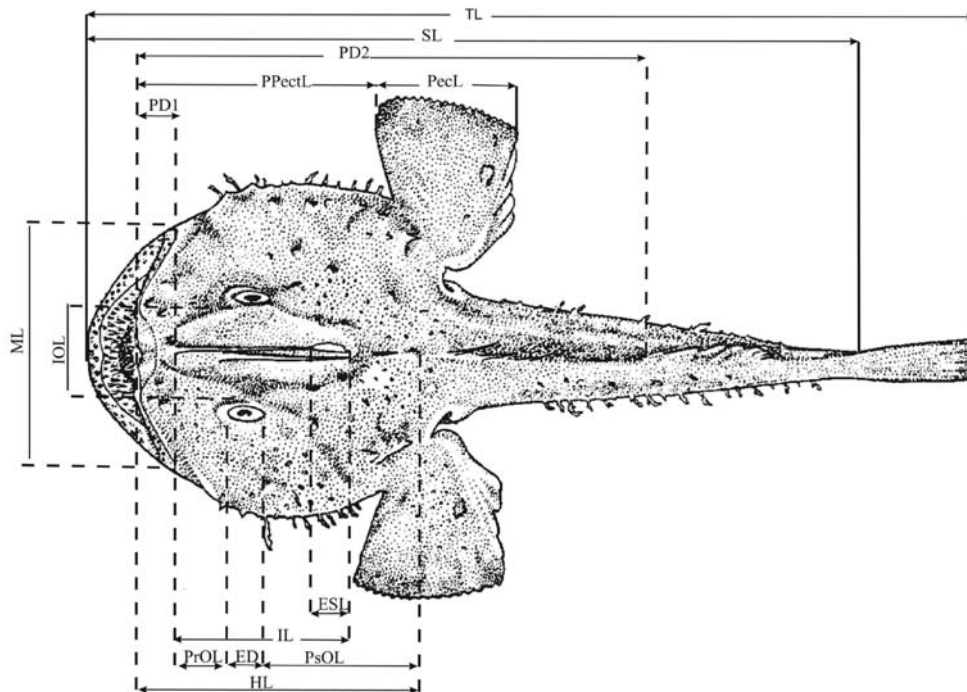


Fig. 3: Morphometric characters measured on dorsal surface in both *L. budegassa* and *L. piscatorius*: total length (TL), standard length (SL), head length (HL), eye diameter (ED), pre-orbital length (PrOL), post-orbital length (PsOL), inter-orbital length (IOL), maxillary length (ML), pre-pectoral length (PPeclL), pre-first dorsal fin length (PD1), pre-second dorsal fin length (PD2), pectoral length (PeclL), illicium (IL), esca length (EsL).

Sl. 3: Morfometrični znaki, izmerjeni na hrbtni površini morskih spak *L. budegassa* in *L. piscatorius*: celotna dolžina (TL), standardna dolžina (SL), dolžina glave (HL), premer očesa (ED), preorbitalna dolžina (PrOL), postorbitalna dolžina (PsOL), interorbitalna dolžina (IOL), dolžina čeljusti (ML), predpektoralna dolžina (PPeclL), dolžina od gobca do prve hrbtne plavuti (PD1), dolžina od gobca do druge hrbtne plavuti (PD2), dolžina prsne plavuti (PeclL), dolžina kožnega izrastka (IL), dolžina vabe (EsL).

Morphometric characters

The smallest *L. budegassa* was 154 mm total length and weighing 37 g, the largest 700 mm and weighing 4,048 g. The smallest *L. piscatorius* was 190 mm total length and weighing 67 g, the largest 1,090 mm and weighed 16,000 g. There is a positive relationship between total length and total mass for both species, in *L. budegassa*: $\text{Log TM} = 3.03 \text{ Log TL} - 4.46$; $r = 0.97$; $n = 416$, while in *L. piscatorius*: $\text{Log TM} = 3.05 \text{ Log TL} - 4.15$; $r = 0.97$; $n = 127$.

Lengths of illicium and esca for both species were compared in Table 4. There were positive relationships between illicium length and standard length, between

illicium length and head length, between esca length and illicium length for both species (Tab. 5).

Mean comparisons of morphometric indexes between male and female *Lophius budegassa* are given in Table 6, and between male and female *L. piscatorius* in Table 7. Some indexes, such as BD/SL, PD2/SL, PD2/SL, PaL/SL, PecH/SL, IL/SL, ED/HL, IOL/HL, IL/HL and EsL/IL, were significantly different in the first species; PD2/TL and PecH/SL in the second one. Mean comparisons of morphometric indexes between *L. budegassa* and *L. piscatorius* are given in Table 8: SL/TL, BD/SL, HL/SL, PPectL/SL, PD1/SL, PD2/SL, PPeL/SL, IL/SL, ML/HL, IL/HL and EsL/IL were significantly different between the two species.

Tab. 3: Monthly collection of the examined *L. budegassa* and *L. piscatorius* from Tunisian coastal waters.

Tab. 3: Mesečni ulovi preučenih vrst *L. budegassa* in *L. piscatorius* v tunizijskih obrežnih vodah.

Months	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
<i>Lophius budegassa</i>													
Northern area	11	4	10	10	–	–	16	8	23	8	23	28	141
Central area	30	8	8	–	–	41	21	–	–	–	–	6	114
Southern area	–	10	4	19	45	7	38	24	–	7	7	–	161
Total	41	22	22	29	45	48	75	32	23	15	30	34	416
<i>Lophius piscatorius</i>													
Northern area	–	2	–	–	–	–	2	–	13	5	2	14	38
Central area	5	2	3	2	1	21	–	1	–	–	–	2	37
Southern area	–	–	6	–	22	3	4	3	–	2	12	–	52
Total	5	4	9	2	23	24	6	4	13	7	14	16	127

Tab. 4: Comparison of length of illicium and esca for *L. budegassa* and *L. piscatorius*.

Tab. 4: Primerjava dolžine kožnega izrastka in vabe pri vrstah *L. budegassa* in *L. piscatorius*.

Species	n	Illicia	Esca	Specimen	
		TL range (mm)	TL range (mm)	TL range (mm)	mass range (g)
<i>L. budegassa</i>	416	29–240	2–80	154–700	37–4048
<i>L. piscatorius</i>	127	22–397	10–98	190–1090	67–16000

Tab. 5: Relationships between illicium length and standard length, between illicium length and head length, between esca length and illicium length for both species.

Tab. 5: Razmerja med dolžino kožnega izrastka in standardno dolžino, med dolžino kožnega izrastka in dolžino glave ter med dolžino vabe in dolžino kožnega izrastka pri obeh vrstah.

Species	Equations	n	r	Student's t test
<i>L. budegassa</i>	$\text{Log IL} = 1.249 \text{ Log SL} - 2.167$	398	0.90	8.61 (+)
	$\text{Log IL} = 1.308 \text{ Log HL} - 1.075$	398	0.90	9.62 (+)
	$\text{Log EsL} = 1.235 \text{ Log IL} - 2.192$	396	0.90	5.16 (+)
<i>L. piscatorius</i>	$\text{Log IL} = 1.477 \text{ Log SL} - 2.824$	124	0.88	7.21 (+)
	$\text{Log IL} = 1.462 \text{ Log HL} - 1.361$	124	0.87	6.43 (+)
	$\text{Log EsL} = 1.123 \text{ Log IL} - 1.472$	123	0.83	1.97 (+)

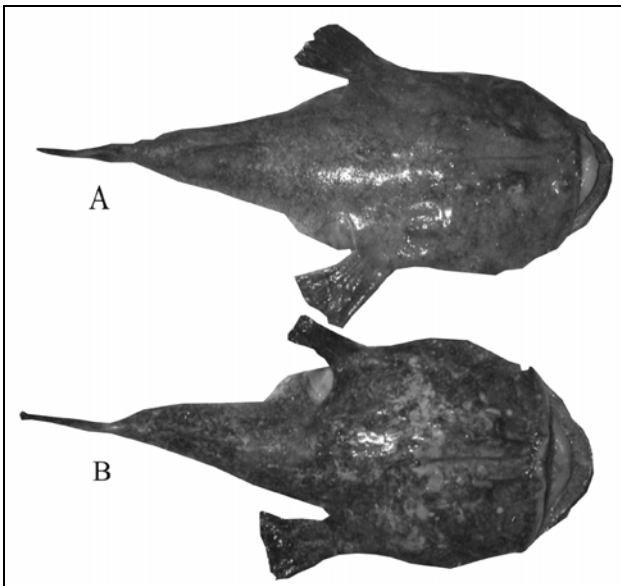


Fig. 4: Dorsal surface. A. *L. budegassa* (FST-LOPH-budegassa-01), B. *L. piscatorius* (FST-LOPH-piscatorius-01).

Sl. 4: Hrbtna površina. A. *L. budegassa* (FST-LOPH-budegassa-01), B. *L. piscatorius* (FST-LOPH-piscatorius-01).

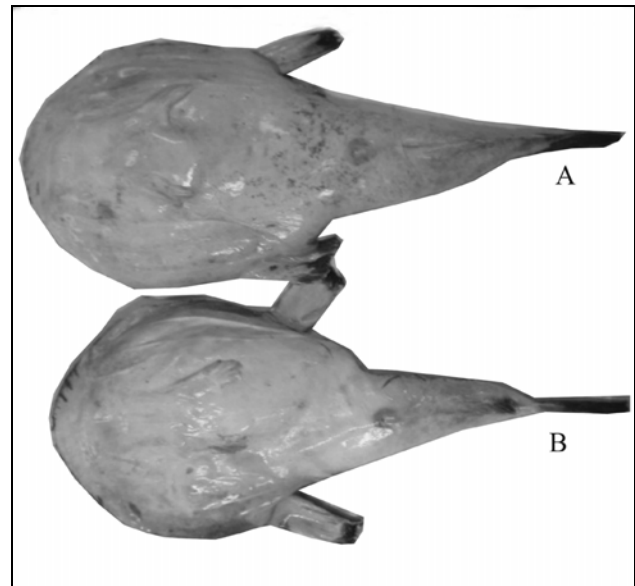


Fig. 5: Ventral surface. A. *L. budegassa* (FST-LOPH-budegassa-01), B. *L. piscatorius* (FST-LOPH-piscatorius-01).

Sl. 5: Trebušna površina. A. *L. budegassa* (FST-LOPH-budegassa-01), B. *L. piscatorius* (FST-LOPH-piscatorius-01).

Of the seven meristic counts used to distinguish *L. budegassa* from *L. piscatorius*, three did not show significant differences for both species. In contrast, four other counts such as number of rays in second dorsal fin, pectoral fin, anal fin and number of vertebrae were significantly higher in *L. piscatorius* than in *L. budegassa*

(Tab. 9). Moreover, the same meristic counts were significantly higher in female than in male *L. budegassa* (Tab. 10); only three meristic counts were significantly higher in female than in male *L. piscatorius*, number of rays in second dorsal fin, pectoral fin and anal fin (Tab. 10).

Tab. 6: Mean comparison of morphometric indexes between male and female *L. budegassa*.

Tab. 6: Srednja primerjava morfolometričnih indeksov med samci in samicami vrste *L. budegassa*.

Index	Males				Females				Student's t test	Snedecor's F test
	n	range	mean	SD	n	range	mean	SD		
SL/TL	135	71.9–90.1	81.80	1.70	280	59.7–102.2	81.90	2.30	0.40 (–)	1.83 (+)
BD/SL	135	3.4–9.4	6.10	0.91	280	3.2–9.5	6.40	0.99	3.06 (+)	1.18 (+)
HL/SL	135	25.3–45.2	37.40	2.20	280	27.3–54.3	37.20	2.40	0.84 (–)	1.19 (+)
PPectL/SL	135	38.6–104.1	44.80	6.00	280	37.7–90.9	44.90	4.30	0.14 (–)	1.95 (+)
PD1/SL	135	59.0–13.9	10.40	1.50	280	5.9–64.1	11.30	3.50	3.66 (+)	5.44 (+)
PD2/SL	135	58.6–79.1	64.00	2.60	280	12.0–92.8	65.60	4.60	4.51 (+)	3.13 (+)
PPelL/SL	135	16.6–33.1	23.00	2.30	280	15.9–48.7	23.40	2.90	1.52 (–)	1.59 (+)
PaL/SL	135	61.7–72.3	67.40	2.20	280	56.5–97.2	69.10	3.00	6.52 (+)	1.86 (+)
PecL/SL	135	14.8–29.4	22.30	3.17	280	14.6–36.5	22.60	3.12	0.91 (–)	1.03 (+)
PecH/SL	135	15.0–27.5	18.50	1.66	280	13.9–28.1	18.10	1.69	2.29 (+)	1.04 (+)
IL/SL	129	11.8–37.4	25.50	3.90	268	1.8–4.3	27.40	5.00	4.13 (+)	1.64 (+)
ED/HL	135	10.0–24	14.00	2.00	280	5.5–25.5	12.40	2.50	7.02 (+)	1.56 (+)
PrOL/HL	135	40.4–84.4	50.40	5.30	280	11.8–89.3	51.30	5.60	1.59 (–)	1.12 (+)
PsOL/HL	135	25.9–52.9	34.60	4.20	280	22.6–57.2	33.90	4.50	1.55 (–)	1.15 (+)
IOL/HL	135	11.6–42.5	23.90	5.40	280	12.6–57.0	26.60	6.30	4.51 (+)	1.36 (+)
ML/HL	135	46.3–77.7	53.60	4.10	280	45.0–82.9	54.20	5.00	1.30 (–)	1.49 (+)
IL/HL	129	32.4–96.3	68.40	11.40	268	34.6–118.4	73.80	14.80	3.99 (+)	1.68 (+)
EsL/IL	127	7.8–48.1	18.00	6.30	268	4.6–46.2	19.80	7.50	2.49 (+)	1.42 (+)

Tab. 7: Mean comparison of morphometric indexes between male and female *L. piscatorius*.**Tab. 7: Srednja primerjava morfometričnih indeksov med samci in samicami vrste *L. piscatorius*.**

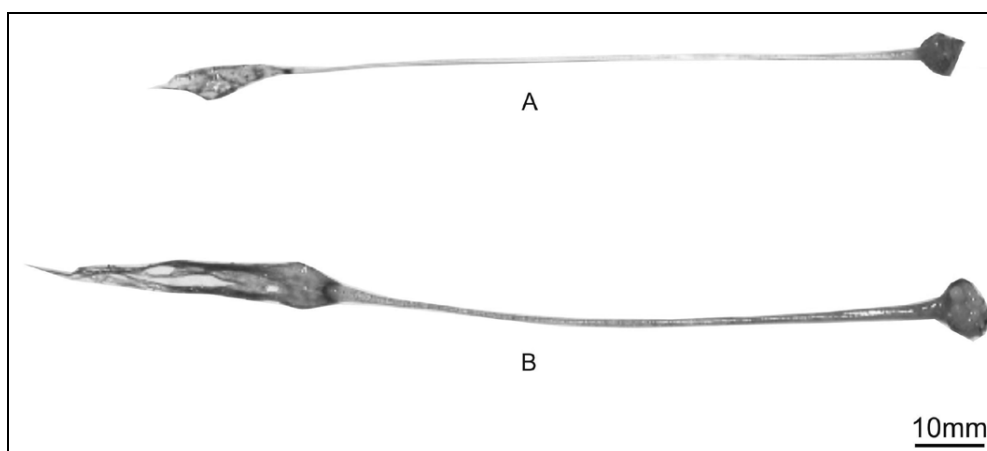
Index	Males				Females				Student's t test	Snedecor's F test
	n	range	mean	SD	n	range	mean	SD		
SL/TL	34	64.3–84.4	81.70	3.20	76	64.5–85.5	82.30	2.30	0.98 (–)	1.93 (+)
BD/SL	34	3.7–10.0	6.50	1.08	76	3.6–9.3	6.70	1.70	0.74 (–)	2.47 (+)
HL/SL	34	35.0–40.6	37.50	1.30	76	26.5–48.5	38.10	2.30	1.78 (–)	3.13 (+)
PPectL/SL	34	39.6–46.1	43.30	1.70	76	36.8–56.8	43.80	2.80	1.15 (–)	2.71 (+)
PD1/SL	34	7.8–16.0	11.80	1.50	76	9.0–16.1	11.90	1.30	0.37 (–)	1.33 (–)
PD2/SL	34	61.8–67.0	63.90	1.30	76	6.0–77.4	64.80	2.20	3.12 (+)	1.51 (–)
PPeL/SL	34	21.3–30.3	25.70	1.80	76	21.1–28.8	25.80	1.60	0.28 (–)	1.26 (–)
PaL/SL	34	64.1–72.7	68.60	1.90	76	57.0–83.3	68.90	3.10	0.62 (–)	2.66 (+)
PecL/SL	34	14.2–29.1	23.20	3.10	76	15.9–30.6	22.80	3.20	0.62 (–)	1.06 (–)
PecH/SL	34	15.4–20.3	17.40	1.10	76	14.7–25.9	18.30	1.60	3.42 (+)	2.11 (+)
IL/SL	33	20.7–40.6	32.00	4.80	74	16.6–55.1	30.10	6.00	1.74 (–)	1.56 (–)
ED/HL	34	8.4–26.3	12.30	3.00	76	7.3–35.8	12.90	3.20	0.95 (–)	1.14 (–)
PrOL/HL	34	42.4–66.3	51.40	5.23	76	38.6–77.0	50.80	5.21	0.56 (–)	1.01 (–)
PsOL/HL	34	26.5–39.4	32.80	3.50	76	23.7–54.7	33.90	4.50	1.39 (–)	1.65 (+)
IOL/HL	34	17.0–37.1	25.60	4.10	76	19.4–41.0	25.90	4.90	0.33 (–)	1.43 (–)
ML/HL	34	45.5–61.4	54.80	3.40	76	43.0–79.2	55.20	4.20	0.53 (–)	1.53 (–)
IL/HL	33	53.7–114.0	85.10	14.10	74	44.7–148.0	79.10	16.60	1.92 (–)	1.39 (–)
EsL/IL	33	11.9–53.9	29.10	8.60	73	17.7–53.9	31.80	7.60	1.55 (–)	1.28 (–)

DISCUSSION

The available data show that *Lophius piscatorius* and *Lophius budegassa* were not frequently landed throughout the year, but the peak occurred in June. Moreover, it appeared that *L. budegassa* is more abundantly fished than *L. piscatorius* off the Tunisian coast as well as in other marine Mediterranean areas (Ungaro et al., 2002), although both species found sufficient food to develop and grow in Tunisian waters, probably due to their both original and ingenious mode of prey captures (Armstrong et al., 1992).

Production of anglerfishes was not very important in relation to total fish production from Tunisian waters ac-

ording to Bradař (2000), probably due to the fact that their contribution is not included in statistics of fishery production from southern Tunisian waters. In contrast, off southern and central Africa, the Cape monk, *Lophius vomerinus* (Valenciennes, 1837) and the African angler *Lophius vaillanti* Regan, 1903 were abundantly landed in commercial trawl fisheries (Caruso, 1990; Maartens et al., 1999). In 1997, for example, 10,430 and 7,640 tons of *L. vomerinus* respectively were landed from Namibia and South Africa (Anonymous, 1998). Both species have a wide bathymetric distribution, from shallow waters down to 800 m depth, accessible by performing fishing gears which, however, are not in use in Tunisian waters.

**Fig. 6: Illcium. A. *L. budegassa* (FST-LOPH-budegassa-01), B. *L. piscatorius* (FST-LOPH-piscatorius-01).****Sl. 6: Kožni izrastek. A. *L. budegassa* (FST-LOPH-budegassa-01), B. *L. piscatorius* (FST-LOPH-piscatorius-01).**

The available Tunisian specimens showed some significant differences in measurements that allow distinguishing *L. budegassa* from *L. piscatorius*. They also revealed sexual dimorphism between each species. We noted the presence of an interspecific variation concerning eleven morphometric indexes SL/TL, BD/SL, HL/SL, PPectL/SL, PD1/SL, PD2/SL, PPeL/SL, IL/SL, ML/HL, IL/HL and EsL/IL and three meristic counts such as number of rays in second dorsal fin, anal fin and number of vertebrae. The dimorphism was observed

with regard to indexes morphometric such as PD2/SL and PecH/SL; in the opposite, no significant difference were recorded between males and females with special regard to the meristic counts above mentioned.

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Tab. 8: Mean comparison of morphometric indexes between *L. budegassa* and *L. piscatorius*.

Tab. 8: Srednja primerjava morfometričnih indeksov med vrstama *L. budegassa* in *L. piscatorius*.

Index	<i>L. budegassa</i>				<i>L. piscatorius</i>				Student's t test	Snedecor's F test
	n	range	mean	SD	n	range	mean	SD		
SL/TL	416	59.7–102.2	81.70	2.10	127	64.3–85.5	82.20	2.50	2.04 (+)	1.42 (+)
BD/SL	416	3.2–10.9	6.30	1.00	127	3.6–10.0	6.70	1.09	3.94 (+)	1.19 (+)
HL/SL	416	25.3–54.3	37.30	2.30	127	26.5–48.5	38.00	2.10	3.21 (+)	1.10 (+)
PPectL/SL	416	37.7–104.1	44.90	4.90	127	36.8–56.8	43.70	2.60	3.60 (+)	3.55 (+)
PD1/SL	416	5.9–64.1	11.00	3.00	127	7.2–16.1	11.90	1.40	4.67 (+)	4.59 (+)
PD2/SL	416	12.0–92.8	65.00	4.10	127	58.0–77.4	64.40	2.10	2.19 (+)	3.81 (+)
PPeL/SL	416	15.9–48.7	23.30	2.70	127	21.1–30.3	25.70	1.60	12.36 (+)	2.85 (+)
PaL/SL	416	56.5–97.2	68.60	2.90	127	40.3–83.3	68.40	3.70	0.56 (–)	1.63 (+)
PecL/SL	416	14.6–36.5	22.50	3.10	127	14.2–30.6	22.60	3.20	0.31 (–)	1.06 (+)
PecH/SL	416	13.9–28.1	18.30	1.60	127	14.7–25.9	18.00	1.50	1.94 (–)	1.14 (+)
IL/SL	398	11.8–42.3	26.80	4.80	124	10.4–55.1	30.00	5.90	5.40 (+)	1.51 (+)
ED/HL	416	5.5–25.5	13.00	2.50	127	7.3–35.8	12.70	3.00	1.02 (–)	1.44 (+)
PrOL/HL	416	11.8–89.3	51.00	5.50	127	38.6–77.3	51.20	5.10	0.38 (–)	1.16 (+)
PsOL/HL	416	22.6–57.2	34.00	4.40	127	23.7–54.7	33.40	4.30	1.50 (–)	1.05 (+)
IOL/HL	416	11.6–57.0	25.70	6.10	127	1.7–41.0	25.90	4.70	0.39 (–)	1.68 (+)
ML/HL	416	45.0–82.9	54.00	4.70	127	4.3–79.2	55.00	4.20	2.28 (+)	1.25 (+)
IL/HL	398	32.4–118.4	72.10	14.00	124	28.9–148.2	79.10	16.50	4.27 (+)	1.39 (+)
EsL/IL	396	4.6–48.1	19.20	7.10	123	11.9–53.9	30.80	8.00	14.41 (+)	1.27 (+)

Tab. 9: Mean comparison of meristic counts between *L. budegassa* and *L. piscatorius*.

Tab. 9: Srednja primerjava merističnih štetij med vrstama *L. budegassa* in *L. piscatorius*.

Species Character	<i>L. budegassa</i>					<i>L. piscatorius</i>					Student's t test	Snedecor's F test
	n	range	mode	mean	SD	n	range	mode	mean	SD		
Second dorsal	416	8–10	9	9.00	0.48	127	10–12	11	11.29	0.52	44.21 (+)	1.17 (+)
Pectoral	416	19–26	23	23.22	1.13	127	22–26	24	23.94	0.87	7.57 (+)	0.59 (–)
Anal	416	8–10	9	8.61	0.53	127	9–11	9	9.52	0.56	16.22 (+)	1.11 (+)
Vertebrae	416	24–28	26	25.63	0.77	127	27–31	29	29.27	0.80	45.27 (+)	1.07 (+)

**Tab. 10: Mean comparison of meristic counts between male and female of *L. budegassa* and of *L. piscatorius*.
Tab. 10: Srednja primerjava merističnih štetij med samci in samicami vrst *L. budegassa* in *L. piscatorius*.**

Species/Character	Sex	Males				Females				Student's t test	Snedecor's F test
	n	range	mean	SD	n	range	mean	SD			
<i>L. budegassa</i>											
Second dorsal fin	135	8–10	9.04	0.41	280	8–10	8.99	0.51	1.07 (–)	0.65 (–)	
Pectoral fin	135	19–26	23.28	1.11	280	19–26	23.19	1.14	0.77 (–)	0.95 (–)	
Anal fin	135	8–10	8.66	0.56	280	8–10	8.56	0.51	1.74 (–)	1.21 (+)	
Vertebrae	135	24–27	25.61	0.77	280	24–28	25.63	0.76	0.25 (–)	0.97 (–)	
<i>L. piscatorius</i>											
Second dorsal fin	34	10–12	11.17	0.39	76	10–12	11.34	0.55	1.85 (–)	1.99 (+)	
Pectoral fin	34	22–25	23.79	0.88	76	22–26	24.00	0.86	1.16 (–)	0.95 (–)	
Anal fin	34	9–10	9.53	0.51	76	9–11	9.56	0.57	0.27 (–)	1.25 (–)	
Vertebrae	34	27–31	29.18	0.83	76	28–30	29.21	0.80	0.18 (–)	0.93 (–)	

MORFOLOŠKI ZNAKI IN MERISTIČNA ŠTETJA PRI MALI MORSKI SPAKI
LOPHIUS BUDEGASSA IN MORSKI SPAKI *L. PISCATORIUS* (OSTEICHTHYES:
LOPHIIDAE), IZ OBREŽNIH TUNIZIJSKIH VODA (OSREDNJE SREDOZEMLJE)

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POVZETEK

Avtorji opisujejo morfološke znake in meristična štetja, opravljena na malih morskih spakah *Lophius budegassa* Spinola, 1807 in morskih spakah *L. piscatorius* Linnaeus, 1758, ujetih v obrežnih vodah Tunizije. Primerjave morfoloških indeksov in merističnih štetij kažejo na določene medvrstne razlike in tudi na spolni dimorfizem pri obeh vrstah. Tako pozitivno kot redno povečanje dolžine kožnega izrastka pri obeh vrstah lahko pomeni izboljšavo v tej "ribolovni napravi" s posebnim ozirom na starost.

Ključne besede: *Lophius budegassa*, *Lophius piscatorius*, morfometrični indeksi, meristična štetja, Tunizija, osrednje Sredozemlje

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